MICROCOMPUTING FOR HOME AND SMALL BUSINESS VOL. 2, ISSUE 9, AUGUST 1977 . \$1.75

CANADA/MEXICO \$2.00

INTERNATIONAL \$3.00

Star-Ship Simulation
Viking UPLINK/DOWNLINK
Orbit Computations
Solar Eclipse Prediction

Sidereal Time Programs

ASTRONOMY/ASTROPHYSICS SPECIAL

# **SWTPC** announces first dual minifloppy kit under \$1,000



Now SWTPC offers complete best-buy computer system with \$995 dual minifloppy, \$500 video terminal/monitor, \$395 4K computer.



#### \$995 MF-68 Dual Minifloppy

You need dual drives to get full benefits from a minifloppy. So we waited to offer a floppy until we could give you a dependable dual system at the right price.

The MF-68 is a complete top-quality minifloppy for your SWTPC Computer. The kit has controller, chassis, cover, power supply, cables, assembly instructions, two highly reliable Shugart drives, and a diskette with the Floppy Disk Operating System (FDOS) and disk BASIC. (A floppy is no better than its operating system, and the MF-68 has one of the best available.) An optional \$850 MF-6X kit expands the system to four drives.



#### \$500 Terminal/Monitor

The CT-64 terminal kit offers these premium features: 64-character lines, upper/lower case letters, switchable control character printing, word highlighting, full cursor control, 110-1200 Baud serial interface, and many others. Separately the CT-64 is \$325, the 12 MHz CT-VM monitor \$175.



#### \$395 4K 6800 Computer

The SWTPC 6800 comes complete with 4K memory, serial interface, power supply, chassis, famous Motorola MIKBUG® mini-operating system in read-only memory (ROM), and the most complete documentation with any computer kit. Our growing software library includes 4K and 8K BASIC (cassettes \$4.95 and \$9.95; paper tape \$10.00 and \$20.00). Extra memory, \$100/4K or \$250/8K.

Other SWTPC peripherals include \$250 PR-40 Alphanumeric Line Printer (40 characters/line, 5 x 7 dot matrix, 75 line/minute speed, compatible with our 6800 computer and MITS/IMSAI); \$79.50 AC-30 Cassette Interface System (writes/reads Kansas City standard tapes. controls two recorders, usable with other computers); and other peripherals now and to come.

#### **Enclosed** is:

- \$1,990 for the full system shown above (MF-68 Minifloppy, CT-64 Terminal with CT-VM Monitor).
- \$995 for the Dual Minifloppy
- \$325 for the CT-64 Terminal \$175 for the CT-VM Monitor
- \$395 for the 4K 6800 Computer
- \$250 for the PR-40 Line Printer \$79.50 for AC-30 Cassette Inferface
- Additional 4K memory boards at \$100
- Additional 8K memory boards at \$250
- Or BAC # Exp. Date Or MC # Exp. Date

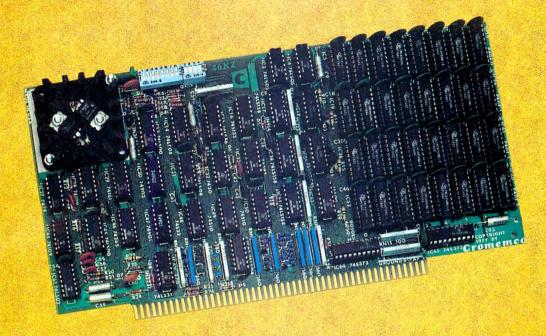
City State

**CIRCLE INQUIRY NO. 52** 



Southwest Technical Products Corp.

219 W. Rhapsody, San Antonio, Texas 78216 London: Southwest Technical Products Co., Ltd. Tokyo: Southwest Technical Products Corp./Japan



# The new 16K RAM card that turns your computer into a working giant

Available now store/factory

Here's the industry's leading 16K RAM card.

It has two outstanding features that make it important to you:

(1) It's fast: It operates up to 4 MHz with no wait states. That's important because it lets you run programs on your Cromemco Z-1 and Z-2 computers in about half the time required by other systems. Even if your present computer is not 4 MHz fast, this new Model 16KZ RAM equips you for the time when you'll need and want higher computer speed.

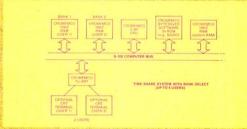
(2) It has Cromemco's Bank-Select feature. Bank-Select lets you expand memory far beyond 64K bytes. Not just beyond 64K but far beyond - up to 512K bytes if you wish. Again, with Cromemco you get present outstanding performance plus obsolescence

protection.

Bank-Select lets you organize memory into 8 banks of 64K each. The active bank is software-selected.

A useful giant

Whatever your S-100 bus computer - Cromemco, Altair 8800 or IMSAI 8080 - you can have enormous memory with the new Model

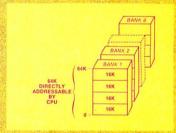


16KZ. You can run the large programs and files that make computers truly valuable - that take them out of the toy class and make them useful, producing units.

With Bank-Select you can even operate an S-100 bus computer as a time-share computer with up to 8 stations. A given memory bank can be accessed only by one station, so there is full confidentiality.

Advanced Cromemco engineering

Designing a 16K RAM card to operate at 4 MHz is a significant engineering accomplishment. That's why



Cromemco with our strong engineering staff is the only manufacturer to offer such a card.

And notice that this advanced card is available and ready for delivery at your store or from the factory.

16K RAM memory kit

(Model 16KZ-K) ..... \$495.

16K RAM memory assembled, tested, and burned in for 160 hours (Model 16KZ-W) .... \$795.

Mastercharge and BankAmericard accepted with signed order. Show complete card number and expiration date.

California users add 6% or 6½% sales tax as applicable.



Specialists in computers and peripherals 2400 CHARLESTON RD., MOUNTAIN VIEW, CA 94043 . (415) 964-7400

INTERFACE AGE 1

**FEATURES** 



#### **COVER STORY**

The nebula pictured on this month's cover is Eta Carinae (NGC 3372) photographed through a four-meter telescope.



The constellation Carina is the keel of the Argonaut's Ship with Puppis, Pyxis and Vela forming the super-constellation Argo Navis. This star group is one of the principal beacons in the sky of the Southern Hemisphere. Manned and unmanned space vehicles make use of the alpha star in this group, Canonus as counterfix anchor with Canopus, ás counterfix anchor with

the Sun.

The photograph of the nebula Eta Carinae is the copyright property of The Association of Universities for Research in Astronomy, Inc., The Cerro Tololo InterAmerican Observatory and was furnished through the courtesy of Kitt Peak National Observatory in Tucson, Arizona.

We wish to express our appreciation to Heath Company of Benton Harbor, Michigan, for providing the H8 8080 computer kit and the H9 video terminal, and Celestron International of Torrance, California, for supplying the Model C-8 telescope, appearing on this month's cover.

| Advertiser Index         |
|--------------------------|
| Book Reviews121          |
| FIFO Flea Market 173     |
| From the Fountainhead 20 |
| Hardware Section102      |
| Interfacial              |
| Letters to the Editor 8  |
| Micro-Market             |
| New Products107          |
| Product Preview132       |
| Programming the Human    |
| Computer 18              |
| Sense Line               |
| The Jurisprudent         |
| Computerist 16           |
| Update and Calendar 12   |
|                          |

#### MICROCOMPUTING FOR HOME AND THE SMALL BUSINESSMAN

| THE SHADOW OF WHAT?   | by Linda Folkard-Stengel,<br>Associate Editor   | 30   |
|---|---|------|
| LOCAL MEAN TIME  A PROGRAM TO PROVIDE CORRECTIONS FOR ANY GIVEN LONGITUDE IN RELATION TO GREENWICH MEAN TIME                      | by James J. Brennan                             | 32   |
| LOCAL SIDEREAL TIME AND DATE A PROGRAM TO PROVIDE ADJUSTMENT BETWEEN GREENWICH SIDEREAL TIME, JULIAN DATE AND LOCAL SIDEREAL TIME | by James J. Brennan                             | 33   |
| A KIM-1 SIDEREAL/SOLAR CLOCK AN ASTRONOMICAL PROGRAM TO FIT INTO KIM-1 SCRATCHPAD AREA  | by John O. Bumgarner                            | 36   |
| SOLAR ECLIPSE PREDICTION BY M A 16-YEAR-OLD COMPUTERIST/ASTRONOMER USES AN IMSAI 8080 TO PREDICT COMING SOLAR ECLIPSE             | ICROCOMPUTER                                    | 38   |
| COMPUTING THE POSITIONS AND O<br>A SIGHT-POINTING PROGRAM FOR FINDING<br>THE POSITIONS OF PLANETS IN OUR<br>SOLAR SYSTEM          | DRBITS OF THE PLANETSby Timothy O'Shaughnessy   | 48   |
| VIKING UPLINK/DOWNLINK AN EXPLANATION OF THE COMPUTER "CONVERSATIONS BETWEEN EARTHBASE AND MARBASE"                               | BY Sven Grenander,<br>NASA-J.P.L., Pasadeηa, CA | . 56 |
| STAR-SHIP SIMULATION - PART I FIRST OF A THREE-PART FEATURE ON REAL-LIFE AND SCIENCE-FICTION SIMULATION TECHNIQUES                | by Roger C. Garrett                             | 94   |
| HARDWARE FEATURES   |   |      |
| THE BENTON HARBOR BUS: ANOTI  | HER APPROACH                                    | 102  |
| CARD OF THE MONTH, THE E D.A. A.  | 11000 00  | 100  |

THE COSMAC MICROPROCESSOR

SOME REMARKS ON MEMORIES ...

| TELETYPE BRPE PUNCH INTERF   | ACE                                   | 2 |
|------------------------------|---------------------------------------|---|
| SOFTWARE FEATURES            |                                       |   |
| SOFTWARE EDITORIAL           | by Robert A. Stevens, Software Editor | 2 |
| FORTRAN/BASIC CONVERSIONS    | By William C. Thompson III            | 0 |
| HIGH DENSITY TAPE PUNCH — E  | 3-1 PUNCH                             | 3 |
| HIGH DENSITY TAPE LOAD — B-1 | 1 LOAD                                | 7 |
| TIC TAC — GAME               | by Bud Shamburger,                    | 0 |

by Brian Kapitan

by Gordon Berry

INTERFACE AGE Magazine, published monthly by McPheters, Wolfe & Jones, 13913 Artesia Blvd., Cerritos, Calif. 90701. Subscription rates: U.S. \$10.00, Canada/Mexico \$12.00, all other countries \$18.00. Make checks payable in U.S. funds drawn on a U.S. bank. Opinions expressed in by-lined articles do not necessarily reflect the opinion of this magazine or the publisher. Mention of products by trade name in editorial material or advertisements contained herein in no way constitutes endorsement of the product or products by this magazine or the publisher.

INTERFACE AGE Magazine COPYRIGHT © August 1977 by McPheters, Wolfe & Jones. ALL RIGHTS RESERVED. Material in this publication may not be reproduced in any form without permission. Requests for permission should be directed to Nancy Jones, Rights and Permission, McPheters, Wolfe & Jones, 13913 Artesia Blvd., Cerritos, Calif. 90701.

POSTMASTER: Please send change of address form 3579 and undelivered copies to INTERFACE AGE Magazine, 13913 Artesia Blvd., Cerritos, Calif. 90701. Second-class postage paid at Artesia, California 90701 and at additional mailing offices.

CRAZY BALL - GAMES . . .



# Print Your Heart Out.

#### With help from the Digital Group, naturally.

Now, that small computer system you own or have been considering for personal or business use suddenly becomes a lot more usable—with the addition of a full-size *impact* printer from the Digital Group. A printer designed for small computers that need big output (like yours).

With the Digital Group printer, you can print your heart out...and it won't cost an arm and a leg. The Digital Group printer is available for less than \$500. That's right—\$500.

#### Just look at these specifications:

- Fast—120 characters per second
- 96 characters per line
- 12 characters per inch horizontal
- 6 lines per inch
- Makes up to 4 copies simultaneously
- Character set and pitch variable under software control—double width characters, etc.
- 5 x 7 character matrix
- Ribbon has built-in re-inkers for a life of 10,000,000 characters
- Paper can be either a standard 8½-inch roll, fanfold or cut page
- Interfaces to 8-bit parallel ports

There are lots of capabilities and outstanding features of the Digital Group printer...and (as always) the best news is our price. Kit prices start as low as \$495 for the printer and interface card. It simply can't be beat.

Find out all the facts about the Digital Group printer now. Just fill in the coupon below or give us a call for the details. We think you'll find a place for our printer in your system ...and in your heart.



P.O. Box 6528 Denver, Colorado 80206 (303) 777-7133

Quick. I want to print my heart out. Send me all the details on your full-size impact printer.

Address \_\_\_\_\_

City/State/Zip\_\_\_\_\_

Please print.

# IPMERFACIAL



Since the beginning of the year INTERFACE AGE has published articles about several fields in which microcomputers are now in extensive use, such as medicine, cybernetics, industrial security, to name a few. This month Space is the theme with contributions from both professionals and amateurs. A special editorial heads the section.

Three new columnists have joined us. Merl Miller with his humorous views on programming starts at the alpha point in PROGRAMMING THE HUMAN COMPUTER. Elliott McLennon and Stephan Murtha instruct the reader on legal points of the technology and industry of computers in THE JURISPRUDENT COMPUTERIST. SENSE LINE continues with a new author, publisher Bob Jones, while INTERFACE AGE's "Enfant Terrible," Adam Osborne displays his usual puckish candor to the dismay of manufacturers with a penchant for oversell.

Again a solid fare of hardware and software is presented in response to reader demands. Roger Edelson evaluated the E.P.A. MICRO-68 and reports his findings on page 122.

In the domain of the "Why doesn't someone publish. . ." query, we received numerous requests for a FOR-TRAN/BASIC conversion program. Bob Stevens responded with a contribution from Wm. C. Thompson III.

Though included as part of the Astronomy/Astrophysics Special, Roger Garrett's STARSHIP SIMULA-TION deserved additional mention within the subject of software. This is a three-part feature which not only describes the anatomy of the aristocrat of TREKKIE's games, but also teaches the fundamentals of structured programming and stresses this system as preventive medicine for a host of programming ills. Part II is due in September and the conclusion will be published in the October issue.

Your letters are interesting and for us thought-provoking. We enjoy the feedback. Because of your favorable response to our ROBOTICS Special last April, we have decided to repeat that theme next April. Three more Floppy ROM issues are

planned for the coming year and three business application months are already blocked out.

The juvenile computerist population is very active, but we do not hear much from women. Come "out of the closet," ladies. We know you are there. Thousands of you are programming for a livelihood and each year more of you are being graduated from schools in this discipline, so start writing.

You have seen two new logos in our staff box. They represent our admission to membership into two professional organizations, one for the magazine and the other for individuals on the staff. We are proud of both memberships for they represent the seal of approval of our peers in the profession.

WPA, Western Publishers' Association is an organization representing the interests of publishing houses headquartered within the fourteen Western States. It is composed of member houses engaged in all branches of the printing medium. Its statement of purpose is to promote the welfare of the industry within its geographic area. Each year the Maggie Awards recognize outstanding effort of the members. INTERFACE AGE was proud to make the finals in two categories. Next year we hope to win.

The ASBPE, American Society of Business Press Editors is a professional organization of editors employed in the specialized print medium. Membership is individual. Its purpose is to provide a forum for the exchange of ideas within the group; to encourage ethical standards of conduct in the practice of business journalism and to represent the profession to the public and to the other media of the Fourth

In this organization there are no public awards, merely the very private satisfaction that self-respect and integrity carries its own reward. Journalists in all fields are romantic and we are proud to admit it.

13913 Artesia Boulevard Cerritos, CA 90701 (213) 926-6629

> **PUBLISHER &** EDITOR-IN-CHIEF ROBERT S. JONES

ASSOCIATE EDITOR LINDA FOLKARD-STENGEL

**GENERAL MANAGER** NANCY A. JONES

**ASSISTANT MANAGER** EVA YAKA

> NORTHWESTERN REGIONAL EDITOR ADAM OSBORNE, PhD

HARDWARE EDITOR ROGER EDELSON

SOFTWARE EDITOR ROBERT STEVENS

CONTRIBUTING **BUSINESS EDITOR** BUD SHAMBURGER

PRODUCTION LAYOUT EDITOR

MIKE ANTICH

ART CHARLYNE LEVANDOWSKI MERRILYN JOYCE

PRODUCTION ARTIST KATHY ROBERTSON

SUBSCRIPTION CIRCULATION JO ANN FERGUSON

> **TYPOGRAPHER** MELODY A. MARTENS

**Editorial Correspondence** Direct all correspondence to the appropriate editor at: INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701.

NATIONAL SALES MANAGER BRUCE BERKEY

**ADVERTISING-Representative** STEVE RICHARDS-ZACH BOVINETTE

Advertising Inquiries

Direct all advertising inquiries to: Advertising Dept., INTERFACE AGE Magazine, 61 South Lake Ave., P.O. Box 4566, Pasadena, CA 91106. (213) 795-7002.

> DOMESTIC RETAIL CIRCULATION ZACH BOVINETTE (213) 795-7002

JAPAN CIRCULATION KAZUHIKO NISHI

ASCII Publishing - 305 HI TORIO 5-6-4 Minami Aoyama. Minato-ku, Tokyo 107 Japan Telephone: (03) 407-4910

> UNITED KINGDOM CIRCULATION VINCENT COEN

L.P. Enterprise, 313 Kingston Road, Ilford. Essex, England IGIIPJ. Telephone: 01-553-1001







Parity protect

Introducing four new memory boards to the Micro-Computer community.

Features of these new boards include: 16 or 32K RAM memory • Phantom line

ALTAIR/IMSAI bus compatible · ROM lockout

Fully assembled, burned in and tested • Guaranteed for one year On board refresh; no wait states • Write protect, full or partial board

 $\mbox{MIL}$  spec boards  $\cdot$  Factory prime chips  $\cdot$  Guaranteed delivery schedule

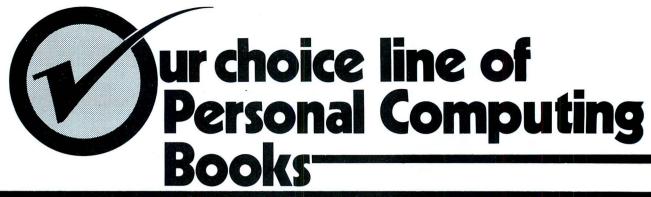
Hard disc with intelligent controller for S-100 bus AVAILABLE SOON INQUIRIES WELCOME M100/16 \$485.00 M100/32 \$885.00 with parity \$560.00 with parity \$990.00

CRE4

**COMP** SYSTEMS, INC

(516) 585-1606 TWX 510-228-1097

4175 VETERAN'S HIGHWAY RONKONKOMA, N.Y. 11779





MICROPROCESSOR BASICS (Elphick) Selection and application info on 8 popular micro's, including the 8080, 6800, F8, IMP, and 6100. #5763-6, paper, \$9.95

THE BASIC WORKBOOK: Creative Techniques for Beginning Programmers (Schoman) "Hands-on" learning of problem-solving using a computer. #5104-2, paper, \$4.25

**GAME PLAYING WITH BASIC** (Spencer) Over 50 easy-to-learn and challenging games and puzzles for your personal computer. #5109-3, paper, \$6.95

**TELEPHONE ACCESSORIES YOU CAN BUILD** (Gilder) Fully-illustrated, step-by-step instruction on building useful phone accessories at a fraction of the commercial cost. #57.48-2, paper, \$3.95



STANDARD DICTIONARY OF COM-PUTERS AND INFORMATION PROC-ESSING, Revised Second Edition, #5099-2, Available Oct. '77.

APPLIED COMPUTING: Putting Your Computer to Work, #5761-X, Available Jan. '78.

PROGRAMMING THE PROGRAM-MABLE CALCULATOR #5105-0, Available Jan. '78

HAYDEN BOOK COMPANY, INC.



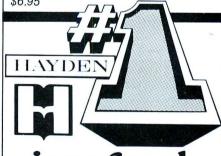
MICROPROCESSORS: New Directions for Designers (Torrero) "...a useful book for the electronics design engineer." BYTE MAGAZINE. #5777-6, paper, \$10.95

FUNDAMENTALS & APPLICATIONS OF DIGITAL LOGIC CIRCUITS (Libes) "A great book for use as a reference by people who are learning digital electronics." PEOPLE'S COMPUTER COMPANY. #5505-6.

BASIC BASIC: An Introduction to Computer Programming in BASIC Language (Coan) "... an excellent introduction... clearly written and well-organized." COMPUTING REVIEWS. #5872-1, paper, \$7.95

paper, \$6.95

ADVANCED BASIC: Applications & Problems (Coan) "This one rates well above average." DATA PROCESSING DIGEST. #5855-1, paper, \$6.95



in personal computing books!

AVAILABLE AT YOUR LOCAL COMPUTER STORE!



GAME PLAYING WITH COMPUTERS, Revised Second Edition (Spencer) #5103-4, cloth, \$16.95

COMPUTERS IN ACTION: How Computers Work (Spencer) #5861-6, paper, \$5.50

COMPUTERS IN SOCIETY: The Wheres, Whys, & Hows of Computer Use (Spencer) #5915-9, paper, \$5.50

**PROGRAMMING PROVERBS** (Ledgard) #5522-6, paper, \$6.50

PROGRAMMING PROVERBS FOR FORTRAN PROGRAMMERS (Ledgard) #5820-9, paper, \$6.50

COBOL WITH STYLE: Programming Proverbs (Chmura & Ledgard) #5781-4, paper, \$5.45

MINICOMPUTERS: Structure & Programming (Lewis & Doerr) #5642-7, cloth, \$12.95

DIGITAL SIGNAL ANALYSIS (Stearns) #5828-4, cloth, \$19.95

FORTRAN FUNDAMENTALS: A Short Course (Steingraber) #5860-8, paper, \$4.95

DIGITAL TROUBLESHOOTING: Practical Digital Theory and Troubleshooting Tips (Gasperini) #5708-3, paper, \$9.95

DIGITAL EXPERIMENTS: Workbook of IC Experiments (Gasperini) #5713-X, paper, \$8.95

COMPUTER MATHEMATICS (Conrad, Conrad, & Higley) #5095-X, cloth, \$13.95

V NC. 50 Essex Street, Rochelle Park, New Jersey 07662



#### It's like adding a room to your brain!

powerful problem solver in a single walnut cabinet. This machine allows you to perform complex financial, engineering, and scientific models in the comfort of your office or den.

The high speed video display presents your results in text, tables and graphics. The detachable typewriter-like keyboard permits relaxed program entry and operation. Convenient mini-discs store programs and data for compact filing, secure storage, and fast access. Our disc BASIC programming language is simple enough for the computer newcomer, yet powerful enough to amaze the most advanced users.

The whole family can immediately use and enjoy preprogrammed applications and educational packages. Let the System 8813 become your trusted business, profession, and

The System 8813 from PolyMorphic Systems is a complete, personal tool. The PolyMorphic Disc System is a completely assembled and tested unit with brushed aluminum front panel, walnut cover, detachable keyboard, video monitor, 16K RAM. Includes system software and fully extended BASIC on disc.

> System with 1 disc drive — \$3250 System with 2 disc drives — 3840

> System with 3 disc drives — 4430

Delivery 60 days ARO. Upgrade packages for POLY 88 owners will also be available. Prices and specifications subject to change without notice.

Polv/Morphic

(805) 967-0468 460 Ward Drive, Santa Barbara, CA 93111

# LETTERS TO THE EDITOR

Dear Editor:

I found your article "Help Your Computer Understand Your Voice" in INTERFACE AGE (May 1977) to be very interesting and intriguing. As it happens, I have just recently begun to explore the possibility of using microcomputers for the purpose of making spectral analyses of various speech sounds. Your article seems to be quite relevant to my aims. I would like very much to hear more about your set up. I am also interested in the Spectrum-128 and how I might obtain one.

Incidentally, in describing the spectrum of each vowel, you used such terms as "major component," "second strongest component," etc. In speech acoustics these relative spectral peaks are referred to as *formants*. These formants are the result of the resonance response characteristics of the vocal tract to a sound source. How the vocal tract responds to a sound source depends on its size and shape.

In your Table II, I found some discrepancies between your data for English vowels and that found in the literature-both calculated values and measured values. For example, you indicate that the formants for the vowel E as in pea are at 187 Hz, 375 Hz, 2187 Hz, 2375 Hz, 2562 Hz, 3062 Hz, 3250 Hz, and 3687 Hz. According to the measurements of two noted authorities, the average values of first three formants of the vowel E are 270 Hz, 2290 Hz, and 3010 Hz. This suggests to me that some of your major peaks are spurious ones. A smoothing of the spectral curve would yield a better picture of the formant pattern.

I am looking forward to hearing from you.

Raymond S. Weitzman Cal State U. — Fresno

This letter was forwarded to the author, Owen F. Thomas for personal reply.

—editor

Dear Editor:

I picked up one of your issues at a local electronic supply store. I found it just what I was looking for. A very

excellent magazine for a beginner like me. Keep up the great work.

R. L. Bauerle II Indianapolis, IN 46204

Dear Editor:

Do you know any source of a "full" 8080 BASIC including trig, log, and exponential functions and assembly language calls which is available on ASCII Teletype tape (both source and object code) with full source listings, for a reasonable price? (String and Matrix operations would be nice but are not urgently needed.) We bought an IMSAI 8080 processor a year ago on the firm promise that their 12K BASIC would do the job; an actual price for paper tape and listings was guoted to us. and we submitted our order accordingly. We are now stymied because they refuse to release it in anything other than their floppy disc format.

> Robert J. Hanrahan, Ph.D. Professor Physical Chemistry University of Florida Gainesville, FL 32611

We are publishing this reader's entire address. Can you help him?

-editor

Dear Editor:

Enjoyed your article "Day of the Week Program" in the June 1977 issue of INTERFACE AGE Magazine. Have already added it to my files. Many thanks! I hope you will inform me how to incorporate in my machine the control function referred to as Step 9. The one that causes home-up and erase screen. I have a SWTPC-M6800, KBD, AC-30, PR40, Ball Bros. Video Monitor, 4K and 8K BASIC. I have no hardware nor software training. What I know I've acquired from books. My occupation is a telephone man. Hope to hear from you. Many thanks.

George Lingo Edgerton, Wisc. 53534

This letter was forwarded to Jim Huffman for personal reply.

Dear Editor:

I am a computer science-electrical

engineering student at Lamar University in Beaumont, Texas. I have always enjoyed your magazine.

When I bought the April 1977 issue I decided to send in my subscription. Your robotics section was fantastic!

I have been designing a robot for approximately three years now. I was hard-up for a simple efficient steering mechanism until I read Tod Loofbourrow's article "Mike — A Computer Controlled Robot."

I would like to correspond with Tod directly but I don't have his address. I would also like to join the United States Robotics Society. If you will, please send those addresses back to me in the enclosed, stamped envelope.

Two of my colleagues are also interested in robotics but could not get a copy of the April issue before it sold out at the newsstand. Please send us two of the April back issues if possible. I am enclosing a check to cover the cost.

Thank you for your help, and thank you for publishing the best computer hobbyist magazine on the stands!

Sincerely, Tim Magnuson Beaumont, TX 77710

Your letter pleased us immensely. Thank you for the compliments. The United States Robotics Society can be contacted through Box 26484, Albuquerque, NM 87102. —editor

Dear Editor:

Your interfacial (May 1977) indicates that you're pining away to hear from the silent majority who read, digest, and move on. Let me try to drop a few reactions to you.

There are getting to be a lot of microcomputer journals around. All of them seem to want to be all things to all people . . . hardware, software, new products, etc. What I look for, and often don't find, is a distinctive personality in each magazine.

Two very distinctive publications (to my mind) are Dr. Dobbs Journal and Creative Computing. Both appear to be specifically directed at a

certain kind of person; both have a distinctive editorial style and a unique appearance. And good. I can tell right away if I want that type of material or not, and choose accordingly.

But INTERFACE AGE - a very good magazine incidentally - is a little harder to separate from the other glossies. Let's see now where did I read that article on speech synthesis? It might have been in ... well ...

Your hardware section is distinctive, and great. I can depend on IN-

TERFACE AGE to publish complete circuitry, so I can piece out the details of a system for myself ("Let's see: could I interface the Dazzler to my KIM-1 system . . .?"). And it's not done under the guise of a how-to article which suddenly proves to be a commercial product ("Here's how to build a dingbat emulator, but it's really very complex, so you can buy a ready-made one from me at my company address of ...").

Software is trickier. Everybody has different languages (even if they

are all BASIC's). I'd turn to Creative Computing if I were looking for BASIC games. Outside that field, you have such a variety of interests and of languages that it becomes difficult to know what will have a broad appeal. 'Biggies' like Interpreters and Compilers are certainly of broad interest - but they sure take up room, don't they?

Your Floppy-ROM™ is a real tourde-force. The concept, the execution, and the program itself really wiped me out. I can't use this one myself since I don't have a 6800, but

#### Dear Editor:

First of all, congratulations to INTERFACE AGE for an extremely practical idea. The Floppy ROM in your May issue makes use of two pieces of equipment which many personal computerists already own; a record player and a cassette interface. It thereby makes machine readable software available without the necessity for a lot of special hardware.

Since I do not own a 6800 system, I cannot comment on how well your BASIC interpreter works, but I can offer some remarks concerning my success in reading the test characteristics and binary loader portion of your record using a KIM-1 and a CT-1024 (SWTP) CRT display.

In a few words, it was easy!

The KIM-1 has an on-board FSK demodulator which uses a 565 phase-locked-loop to detect the 2400 Hz and 3700 Hz tones used for the cassette interface. The center frequency for this detector can be adjusted by

way of a potentiometer, VR1.

In order to demodulate the 1200 Hz and 2400 Hz tones used for "Kansas City" recordings, the center frequency must be adjusted to approximately 1800 Hz. I say "approximately" because this detector is very forgiving, and although the 1800 Hz setting was not within the range of adjustment of my KIM-1, I found that just setting VR1 to the fully counter-clockwise position worked fine.

The demodulator output is routed through a gate to one of the programmable I/O pins, where it is sensed under software control by the cassette interface program. Because of the gate, the sensed data is inverted. Another of the programmable I/O pins is used for teleprinter output.

It is therefore possible, to use a short routine to sample the output of the FSK demodulator, invert the data, and then send it to the teleprinter for display. The enclosed eight-step loop is all that is needed for a 'quick and dirty" implementation. Exit from the loop

must be by interrupt or reset.

This approach does not require any modification of the hardware, except for an easy-to-restore change in the setting of a screwdriver adjustment. Furthermore, the speed accuracy of quality hi-fi turntables is good

enough that the self-clocking feature of the "Kansas City" format is not needed, and the simple setup described works quite well. Except for the setting of VR1, the setup is just as described in the KIM-1 manual. The audio from the record is fed through the cassette tape input, and the ASCII data is displayed on the teleprinter.

I was hoping to have a binary loader, to load your 6800 program into my KIM-1, before writing to you. However, I had the record for three weeks before I got started on the project, and here it is June already. Consequently, I'm sending what I have now. I suspect that many KIM-1 owners would find this information useful as a starting point for a "Kansas City" input to their machines. If you will tell me what format you plan to use for recording 6502 programs, I will write the rest of the loader for the KIM-1 and send it to you.

| DPYKCT — DISPLAY "KANSAS CITY" TAPE ON TTY |          |       |        |         | NTTY               |
|--|----------|-------|--------|---------|--------------------|
| ADDRESS                                    | DATA     | LABEL | OPCODE | OPERAND | COMMENTS           |
|  |          | PBD   | EQU    | \$1742  | I/O REGISTER B     |
|  | AD 42 17 | TEST  | LDA    | PBD     | SAMPLE FSK DET     |
|  | 10 07    |       | BPL    | ONE     | MSB LO = LOGIC ONE |
| HE STATE                                   | 29 FE    |       | AND    | #SFE    | FOR MSB HI,        |
|  | 8D 42 17 |       | STA    | PBD     | SET LSB LO.        |
|  | 30 F4    |       | ВМІ    | TEST    | NEXT SAMPLE        |
|  | 0901     | ONE   | ORA    | #\$01   | FOR MSB LO,        |
|  | 8D 42 17 |       | STA    | PBD     | SET LSB HI         |

This routine samples inverted data from the KIM-1 cassette tape FSK detector (PBD BIT 7), corrects for the inversion and relays the data to the TTY port (PBD BIT 0). Samples are taken at 15 or 16 microsecond intervals, depending on the data. The code can be loaded at any convenient address, but must all be on the same memory page to obtain the stated sample times. To read Kansas City tapes, the KIM-1 phase-locked-loop FSK detector must be adjusted for a center frequency of 1800 Hz. (For an approximate setting, turn VR1 fully counter-clockwise.)

NEXT SAMPLE

wow! My compliments to all. Do more!

You're doing a lot of stuff well, and I look forward to every issue. But try to work harder on your own unique identity.

I'm sure you feel, back there in the editorial offices, that you do indeed have a unique style and image. But it doesn't always make it through to us readers.

Where do you stand in the hardware-software-applications spectrum? Tutorial or advanced? Kit or fully-assembled? Games or scientific or process-control or business? Can you be everywhere at once?

Maybe you should make a statement to clarify the kind of publication you think you are. It might help the readers understand more about INTERFACE AGE. It might even help you do the same thing.

Jim Butterfield Toronto, Canada

Thanks for the evaluation. It was refreshing and informative. Concerning our identity in the market, we are not **everything** to everyone, but hopefully we are **`one** thing wanted by everyone. Our policy: thoughtprovoking, informative, and applications-oriented. —editor

Roger Garrett replies to Charles Springer's letter published in May.

How heartwarming to know that someone took the time to seriously consider my article on the Qube. It was a simple idea I had been working on for a few months, and I decided it might be good to get some other people's viewpoints on it. That's how I happened to publish it in INTERFACE AGE.

I appreciate your comments on the feasibility of the concept. The problem with the molecular changes occurring due to frequency and relatively unaffected by candlepower is certainly a huge obstacle to overcome. Perhaps someday someone will come up with a compound that is sensitive only to a particular combination of frequencies but not sensitive to the individual frequencies alone. The problem then reduces to having two lasers of the appropriate frequencies. The setup would be the same as I described in the article

but the point of intersection of the two lasers would be a combination of two frequencies rather than simply an area of increased intensity.

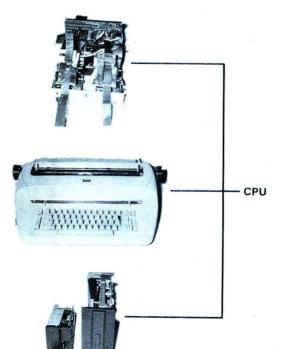
I'm not sure how to overcome the diffraction problem except with the narrow-beam concept I described in the article. it would make the process of building Qubes slow and more expensive, but someone would certainly pay the price if they could get an entire computer in one small hunk of silicon. I would think at least the federal government would be interested.

As for the intersection of two round beams not being a sphere; I had thought about that when I wrote the article. I just couldn't think of a simple way to describe the three-dimensional shape formed by that type of intersection, so I settled for a sphere. I guess it was inevitable that someone would notice it. Perhaps I should have made the two beams square so that the intersection would be a cube. That might be the best way to etch the Qube anyway, sort of a Qube-of-cubes.

Roger Garrett

#### FOR REAL RELIABILITY...at lowest cost

Get the first really effective Selectric® conversion kit. Not a mechanical nightmare or a collection of switches and coils, this unit is designed around specially built solenoids and the latest opto-electronics to achieve a superior product. This product gives you the usage of the same rugged mechanism that has been the industry standard.



|                       | gged mechanism that has been the moustry  | standard.   |
|-----------------------|---|-------------|
| Item                  | Description   | Price       |
| SK-1                  | Selectric conversion kit, with all mechanical and electronic parts. Needs 1 amp at 12 volts   | 148.00      |
| SK-2                  | SK-1 with built-in power supply and TTL compatibility   | 215.00      |
| SK-3                  | SK-2 with controller kit giving RS232 serial ASCII data at 110 or 300 BPS. A high speed paper tape interface is included  | 389.00      |
| DK-1                  | Floppy disk and controller kit, with 350 KB drive. For use with SK-3, or any serial interface, up to 19200 BPS. Contains high level DOS, with simple commands making any terminal a smart one or any serial CPU a disk system | 795.00      |
| Manuals<br>kits. Refu | from above kits are offered for the purpose of eva<br>inds for manuals apply on subsequent kit order.   | luating the |
| SK-D1                 | Selectric Conversion Manual   | 6.50        |
| SK-D2                 | Selectric Programming Manual, with listings and timing data   | 6.50        |
| DK-D1                 | Floppy Disk Kit & DOS Manual  | 6.50        |
| Shipping              | date 1-3 weeks after arrival of order.  |             |



# FLIP OVER OUR FLOPPY



#### Only \$750 from Peripheral Vision.

Peripheral Vision is a brand-new company that's dedicated to selling reasonably priced peripherals for various manufacturers' CPU's.

We think you'll flip over our first product.

It's a full-size floppy disk for the Altair-Imsai plug-in compatible S-100 BUS. And it's available for as low as \$750.

#### Here are the features:

P

- 1 interface card supports 4 drives
- Stores over 300,000 bytes per floppy
- Bootstrap EPROM included—no more toggling or paper tape
- Completely S-100 plug-in compatible
- Interface cabling included
- Drive is from Innovex (the originator of the floppy concept)—assembled and tested
- Interface card design is licensed from Dr. Kenneth Welles and the Digital Group
- Disk operating system with file management system included on floppy
- · Cabinet and power supply optional

| Prices:   | Kit   | Assm  |
|---|-------|-------|
| Interface card kit and assembled and tested drive | \$750 | \$850 |
| Power supply—+24V at 2A                           | 45    | 65    |
| Cabinet—Optima, blue                              | _     | 85    |

#### Now, a little more about our company.

Peripheral Vision may be brand-new, but we have some old-fashioned ideas about how to run our business.

We know there are serious incompatibilities among the different manufacturers' peripherals and CPU's. We want to get them together. And, we want to bring significant new products to market—products consisting of everything from adaptation instructions/kits for hardware and software to major new products.

It's a tall order, but we feel we're up to the task. Peripheral Vision has already obtained a license from The Digital Group to adapt versions of some of their products to the S-100 BUS. And we're working on getting more from other companies.

Most important to our customers, Peripheral Vision is committed to helping you get along with your computer. We'll do all we can to make it easy.

Write us now for all the information on our company, our philosophy and our exciting line of products. And be prepared to flip over all of it.



P.O. Box 6267 / Denver, Colorado 80206 / (303) 733-1678

Send me the works, and I just might flip over it!

| Name           |  |
|----------------|--|
| Address        |  |
| City/State/Zip |  |

AUGUST 1977 CIRCLE INQUIRY NO. 46 INTERFACE AGE 11

## UPDATE

#### COURSE FOR ENGINEERS — TAKE HOME KIM-1

This seminar-workshop has been developed by the American Institute for Professional Education for those members of the engineering and scientific community whose professional growth requires more than a passing acquaintance with the microprocessor. By starting with the digital elements of the microprocessor, this course provides participants with essential insights as to how a microprocessor functions as an electronic device and how it can be applied to solve a variety of problems.

Scientists and engineers learn the most about the microprocessor when they are given hands-on instruction. Therefore, the American Institute has designed this seminar in which each attendee is given—to retain as his personal property after the course—the latest design in computers-on-a-board. This microcomputer serves as an instructional vehicle during the course and as a powerful computing device afterwards. During the intensive three days of lecture and workshop, participants will:

- Learn how a microprocessor functions
- · Learn how it is programmed
- Learn how it can be used as a design element
- Take home a KIM-1 Microcomputer to be given to each attendee

#### Who should attend:

Research engineers, scientists, design engineers, engineering managers, instrumentation specialists, computer professionals, and educators desiring in-depth knowledge of how a microprocessor functions. No direct experience with microprocessor or digital electronics is required. Participants with background in these areas are. however, able to move quite rapidly through the first day's experiments. Special additional projects are assigned in such cases. Participants should have an engineering or scientific background and be able to carry out experiments under faculty direction.

Workshop locations are as follows: Los Angeles, August 1-3, Sheraton Los Angeles Airport, 9750 Airport Blvd., Los Angeles, CA 90045 (213) 645-4600.

Denver, August 8-10, Executive

Tower Inn, 1405 Curtis St., Denver, Colorado 80202, (303) 571-0300.

Seattle, August 15-17, Sheraton-Renton Inn, Rainier Ave. So., Renton, WA 98055, (206) 226-7700.

Phoenix, August 22-24, Sheraton-Scottsdale Inn, 7200 N. Scottsdale Rd., Scottsdale, Arizona 85253, (602) 948-5000.

San Francisco, August 29-31, Miyako, 1625 Post St., San Francisco, CA 94115, (415) 922-3200.

#### HOUSTON PERSONAL COMPUTING FAIRE

Houston, the energy capital of the United States will host a personal computing fair.

The Personal Computing Faire will be held at the Hall of Exhibits, Shamrock Hilton Hotel, So. Main at Holcombe, Houston, TX on Saturday, September 17, 1977, 9 a.m.-6 p.m. and Sunday, September 18, 1977, 9 a.m.-4 p.m. Admission is \$2.00 per person for all events on both days.

Featured will be exhibits by hobbyists of their systems, of manufacturers of latest equipment, a computer chess tournament, computer-generated artwork, and classes and workshops for businessmen, beginners and hobbyists. For registration contact Matt Barkley, HPCF Exhibits Chairman, (713) 667-9535 or P.O. Box 36584, Houston, TX 77036.

#### **COURSE IN MICROPROGRAMMING**

Chaffey Community College at Alta Loma, California, has scheduled a fall-quarter course in microcomputer programming that will be offered in two 12-week class sections.

Both classes will be from 7 to 10 p.m., one on Tuesdays starting Sept. 13 and the other on Wednesdays beginning Sept. 14.

The only prerequisite for the three-unit course is that a student be a high school graduate or 18 years of age. There is no tuition fee entailed for state residents.

Further information may be obtained by writing to Donald J. Ketchum, data processing professor, Chaffey Community College, Alta Loma, CA 91701.

#### COURSE ON EDP FOR GENERAL LEDGER AND FINANCIAL STATEMENT PREPARATION

The American Management Associations will present a series of

courses in developing EDP systems for general ledger and financial statement preparation.

The 2½-day course will cover diverse subjects such as how to plan and design the system, account coding, financial reporting concepts, integrating the data base, conversion planning and control and cost benefits analysis.

First session will be held at the Miyako Hotel, San Francisco, August 15, 1977 and future sessions are to be held at Atlanta Hilton, September 28-30, 1977, and AMA headquarters, 135 West 50th St., New York, NY 10020. Contact Alan Freedman, Program Director at AMA Headquarters in New York or call (212) 586-8100.

#### NEW MICRO INTERFACING WORKSHOP

WINTEK has added a 2 day "HANDS ON INTERFACING WORK-SHOP" to their standard 3-day "HANDS ON MICROPROCESSOR SHORT COURSE WITH FREE TAKE HOME MICROCOMPUTER." The new interfacing workshop includes analog-to-digital and digital-toanalog conversion, signal conditioning, keyboard scanning/decoding, LED display driving, motor position, velocity control, and related topics. Tuition is \$299. The Fall '77 schedule includes workshops in Dallas, Houston, Washington, D.C., Melbourne, FL, Denver, Palo Alto, San Diego, Indianapolis, Boston, Detroit, Chicago, and Puerto Rico. For more information call (317) 742-6802 or write WINTEK Corp., 902 N. 9th St., Lafayette, IN 47904.

#### COMPUCOLOR USERS GROUP TO FORM

This group is dedicated to the exchange of programs and technical data for the Compucolor. Subjects such as how to concatinate tapes and discs will be covered. For each accepted program a member will receive in return a number of other programs. There will be an initial membership fee of \$10.00 to cover the duplication and mailing of materials. A bulletin will be periodically issued. Those wishing to join the group may send the fee to S.P. Electronics at 5250 Van Nuys Blvd., Van Nuys, CA 91401. Further information may be obtained by sending a large self-addressed envelope to this address.

# CALENDAR

#### **AUGUST**

- Aug 1 Amateur Radio Research and Development Corporation (AMRAD) will hold its meeting at 8 PM at the Patrick Henry Branch Library, Maple Ave. at Center St., Vienna, Virginia. For more information write AMRAD, 1524 Springvale Ave., McLean, VA 22101.
- Aug 3 Northwest Computer Club will be holding its meeting at 7 PM at the Pacific Science Center, Rm 200, located in No. Seattle, Washington.
- Aug 3 New England Computer Society Inc. will be meeting in the cafeteria of the MITRE Corp. at 7 PM. Located on Rte 62 in Bedford, Mass. Contact Dave Day at (603) 434-4239 for details.
- Aug 3 SCCS Valley Chapter will hold its meeting in the Harvard School at 7 PM located at 3700 Coldwater Canyon, Studio City, CA.
- Aug 3 Amateur Computer Society of Columbus will meet in the Center of Science and Industry at 7:30 PM. For more information call Fred Hatfield at (614) 486-3347.
- Aug 4 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 PM. For more details write BAMUG, 1211 Santa Clara Ave., Alameda, CA 94501.
- Aug 6 Louisville Area Computer Club will meet in the Speed Auditorium at the University of Louisville at 1 PM. Call Glen Darwin at (502) 456-5589 for more details.
- Aug 6 Ventura County Computer Society (SCCS) meets at 7:30 PM in the Camarillo Public Library, located at 3100 Ponderosa Dr., Camarillo, CA. For more information write VCCS, P.O. Box 525, Port Hueneme, CA 93041 or call (805) 985-2631.
- Auc 6 South Central Kansas Amateur Computer Association meets at 9 AM at 1430 E. Kellog in Wichita, KS. Contact Cris Borger at (316) 265-1120 for club agenda.
- Aug 7 North Orange county Computer Club will have its meeting at the California State University, Fullerton. For more details on time and room call Lorin Mohler at (714) 998-5831.
- Aug 8 Permian Basin Computer

- Group Midland Chapter will meet at 7:30 PM in the Student Union Building on the campus of Midland College.
- Aug 9 Arizona Computer Society meets at 7 PM in room 226 of the DeVry Institute, 4702 N. 24th St., Phoenix, AZ. For more details write Arizona Computer Society, P.O. Box 14391, Phoenix, AZ 85063.
- Aug 10 Homebrew Computer Club meeting will begin at 7 PM in Menlo Park, CA at the Stanford Linear Accelerator Center Auditorium. Contact Bob Reiling at (415) 967-6754 for more information.
- Aug 12 Northern New Jersey Amateur Computer Club will hold its meeting at 6:30 PM at the Fairleigh Dickenson University, Rutherford Campus, Becton Hall Room B8. For more information write NNJACC, 593 New York Ave., Lyndhurst, NJ 07071.
- Aug 12 Crescent City Computer Club will hold their meeting at the University of New Orleans, Lakefront Campus at 8 PM. Contact Bob Latham at (504) 722-6321 for more information.
- Aug: 13 The Permian Basin Computer Group Odessa Chapter will meet in the Electronics Technology Bldg., room 203, at 1 PM on the campus of Odessa College. For further information call (915) 332-9151.
- Aug 13 Oklahoma Computer Club will hold its meeting in the Belle Aisle Library at 10 AM. Call Al Campbell at (405) 842-4933 for more information.
- Aug 18 New York Amateur Computer Club meets at 7 PM. Call Bob Schwartz for meeting place at (212) 663-5549.
- Aug 20 South Central Kansas Amateur Computer Association meets at 9 AM at 1430 Kellog, Wichita, KS. Call Cris Borger at (316) 265-1120 for more details.
- Aug 21 Pittsburgh Area Computer Club. For meeting place and time contact Fred Kitman (412) 931-3800 or Harry Kohman at (412) 931-5866.
- Aug 23 Sacramento Microcomputer Users' Group meets 7:30-9:30 PM at SMUD Training Bldg., 59 St. between Folsom & "S" Sts. Write Richard Lerseth, P.O. Box 161513. Aug 24 Homebrew Computer Club

- meeting will begin at 7 PM in Menlo Park, CA. The Stanford Linear Accelerator Center Auditorium is the site of the meeting. Call (415) 967-6754 for details.
- Aug 25 Space Coast Microcomputer Club will meet at the Merritt Island library at 7:30 PM, Merritt Island, FL. Call Ray Lockwood at (305) 452-2159 for more information.
- Aug 26 Washington Amateur Computer Society will meet at the Catholic University of America, St. Johns Hall, Washington, D.C. For more information call Bill Stewart at (202) 722-0210.
- Aug 28 Chicago Area Computer Hobbyist Exchange (CACHE) will hold its meeting at 12 PM in the cafeteria of the NIGAS Bldg. located on Schermer Rd., Glenview, IL. For more information write CACHE, P.O. Box 36, Vernon Hills, IL 60061 or call (312) 620-1671.

#### **SEPTEMBER**

- Sept 1 Bay Area Microprocessors Users Group (BAMUG) will meet in the Hayward ROC Center, 26316 Hesperian Blvd., Hayward, CA at 7:30 PM. For more details write BAMUG, 1211 Santa Clara Ave., Alameda, CA 94501.
- Sept 3 Ventura County Computer Society (SCCS) meets at 7:30 PM in the Camarillo Public Library, located at 3100 Ponderosa Dr., Camarillo, CA. For more information write: VCCS, P.O. Box 525, Port Hueneme, CA 93041 or call (805) 985-2631.
- Sept 3 Louisville Area Computer Club will meet in the Speed Auditorium at the University of Louisville at 1 PM. Call Glenn Darwin at (502) 456-5589 for more details.
- Sept 3 Milwaukee Area Computer Club will meet at 1 PM at the Waukesha County Technical Institute, New Berlin, WI. Call (414) 246-6634 for further details.
- Sept 4 North Orange County Computer Club will have its meeting at California State University, Fullerton. For more details on time and room call Lorin Mohler at (714) 998-5831.
- Sept 7 SCCS Valley Chapter will be holding its meeting at the Harvard School at 7 PM. The Harvard School is located at 3700 Coldwater Canyon, Studio City, CA.

# See Sol here...

#### ALABAMA

ICP, Computerland 1550 Montgomery Hwy. Birmingham, AL 35226 (205) 979-0707

#### ARIZONA

Byte Shop Tempe 813 N. Scottsdale Rd. Tempe, AZ 85281 (602) 894-1129

Byte Shop Phoenix 12654 N. 28th Dr. Phoenix, AZ 85029 (602) 942-7300

Byte Shop Tucson 2612 E. Broadway Tucson, AZ 85716 (602) 327-4579

#### CALIFORNIA

The Byte Shop 1514 University Ave. Berkeley, CA 94703 (415) 845-6366

Byte Shop of Burbank 1812 W. Burbank Blvd. Burbank, CA 91506 (213) 843-3633

Byte Shop Computer Store 6041 Greenback Lane Citrus Heights, CA 95610 (916) 961-2983

Computer Center 1913 Harbor Blvd. Costa Mesa, CA 92627 (714) 646-0221

Data Consultants, Inc. 2350 W. Shaw, Suite 114 Fresno, CA 93711 (209) 431-6461

Bits 'N Bytes 679 S. State College Blvd. Fullerton, CA 92631 (714) 879-8386 The Byte Shop 16508 Hawthorne Blvd. Lawndale, CA 90260

Opamp/Computer 1033 N. Sycamore Ave. Los Angeles, CA 90038 (213) 934-3566

(213) 371-2421

Digital Deli 80 W. El Camino Real Mountain View, CA 94040 (415) 961-2828

The Computer Mart 624 West Katella #10 Orange, CA 92667 (714) 633-1222

Byte Shop 496 South Lake Ave. Pasadena, CA 91101 (213) 684-3311

The Computer Store of San Francisco 1093 Mission Street San Francisco, CA 94103 (415) 431-0640 Byte Shop 321 Pacific Ave. San Francisco, CA 94111 (415) 421-8686

The Computer Room 124H Blossom Hill Rd. San Jose, CA 95123 (408) 226-8383

The Byte Shop 509 Francisco Blvd. San Rafael, CA 94901 (415) 457-9311

The Byte Shop 3400 El Camino Real Santa Clara, CA 95051 (408) 249-4221

Recreational Computer Centers 1324 South Mary Ave. Sunnyvale, CA 94087 (408) 735-7480

Byte Shop of Tarzana 18424 Ventura Blvd. Tarzana, CA 91356 (213) 343-3919

Computer Components 5848 Sepulveda Blvd. Van Nuys, CA 91411 (213) 786-7411

The Byte Shop 2989 North Main St. Walnut Creek, CA 94596 (415) 933-6252

Byte Shop 14300 Beach Blvd. Westminster, CA 92683 (714) 894-9131

#### COLORADO

Byte Shop 2040 30th St. Boulder, CO 80301 (303) 449-6233

Byte Shop 3464 S. Acoma St. Englewood, CO 80110 (303) 761-6232

#### **FLORIDA**

Sunny Computer Stores University Shopping Center 1238A S. Dixie Hwy. Coral Gables, FL 33146 (305) 661-6042

Delta Electronics 2000 U.S. Hwy. 441 East Leesburg, FL 32748 (904) 357-4244

Byte Shop of Miami 7825 Bird Road Miami, FL 33155 (305) 264-2983

Microcomputer Systems Inc. 144 So. Dale Mabry Hwy. Tampa, FL 33609 (813) 879-4301

#### **GEORGIA**

Atlanta Computer Mart 5091-B Buford Hwy. Atlanta, GA 30340 (404) 455-0647

#### ILLINOIS

itty bitty machine co. 1316 Chicago Ave. Evanston, IL 60201 (312) 328-6800

Reeves Communications 1550 W. Court St. Kankakee, IL 60901 (815) 937-4516

itty bitty machine co. 42 West Roosevelt Lombard, IL 60148 (312) 620-5808

#### INDIANA

The Data Domain 406 So. College Ave. Bloomington, IN 47401 (812) 334-3607

The Byte Shop 5947 East 82nd St. Indianapolis, IN 46250 (317) 842-2983

The Data Domain 7027 N. Michigan Rd. Indianapolis, IN 46268 (317) 251-3139

#### KENTUCKY

The Data Domain 3028 Hunsinger Lane Louisville, KY 40220 (502) 456-5242

#### **MICHIGAN**

The Computer Store of Ann Arbor 310 East Washington Ann Arbor, MI 48104 (313) 995-7616

Computer Mart of Royal Oak 1800 W. 14 Mile Rd. Royal Oak, MI 48073 (313) 576-0900

General Computer Store 2011 Livernois Troy, MI 48084 (313) 362-0022

#### MINNESOTA

Computer Depot, Inc. 3515 W. 70th St. Minneapolis, MN 55435 (612) 927-5601

#### **NEW JERSEY**

Hoboken Computer Works No. 20 Hudson Place Hoboken, NJ 07030 (201) 420-1644 The Computer Mart of New Jersey 501 Route 27 Iselin, NJ 08830 (201) 283-0600

#### **NEW YORK**

The Computer Mart of Long Island 2072 Front Street East Meadow, L.I. NY 11554 (516) 794-0510

The Computer Shoppe 444 Middle Country Rd. Middle Island, NY 11953 (516) 732-4446

The Computer Mart of New York 118 Madison Ave. New York, NY 10001 (212) 686-7923

The Computer Corner 200 Hamilton Ave. White Plains, NY 10601 (914) 949-3282

#### OHIO

Cybershop 1451 S. Hamilton Rd. Columbus, OH 43227 (614) 239-8081

Computer Mart of Dayton 2665 S. Dixie Ave. Dayton, OH 45409 (513) 296-1248

#### OREGON

Byte Shop Computer Store 3482 SW Cedar Hills Blvd. Beaverton, OR 97005 (503) 644-2686

The Real Oregon Computer Co. 205 West 10th Ave. Eugene, OR 97401 (503) 484-1040

Byte Shop Computer Store 2033 SW 4th Ave. Portland, OR 97201 (503) 223-3496

#### RHODE ISLAND

Computer Power, Inc. M24 Airport Mall 1800 Post Rd. Warwick, RI 02886 (401) 738-4477

#### SOUTH CAROLINA

Byte Shop 2018 Green Street Columbia, SC 29205 (803) 771-7824

#### TENNESSEE

Microproducts & Systems 2307 E. Center St. Kingsport, TN 37664 (615) 245-8081

#### TEXAS

Byte Shop 3211 Fondren Houston, TX 77063 (713) 977-0664

Interactive Computers 7646½ Dashwood Rd. Houston, TX 77036 (713) 772-5257

The Micro Store 634 So. Central Expressway Richardson, TX 75080 (214) 231-1096

#### VIRGINIA

The Computer Systems Store 1984 Chain Bridge Rd. McLean, VA 22101 (703) 821-8333

Media Reactions Inc. 11303 South Shore Dr. Reston, VA 22090 (703) 471-9330

#### WASHINGTON

Byte Shop Computer Store 14701 N.E. 20th Ave. Bellevue, WA 98007 (206) 746-0651

The Retail Computer Store 410 N.E. 72nd Seattle, WA 98115 (206) 524-4101

#### WISCONSIN

Madison Computer Store 1910 Monroe St. Madison, WI 53711 (608) 255-5552

The Milwaukee Computer Store 6916 W. North Ave. Milwaukee, WI 53213 (414) 259-9140

#### CANADA

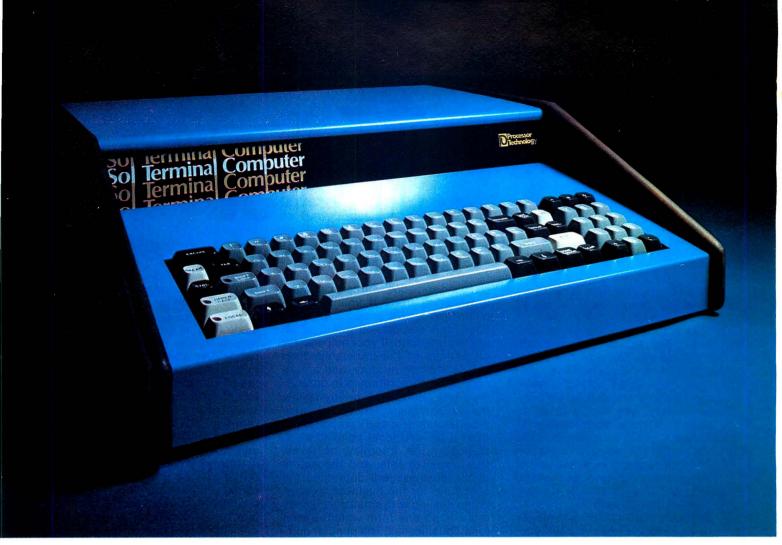
Trintronics 160 Elgin St. Place Bell Canada Ottawa, Ontario K2P 2C4 (613) 236-7767

First Canadian Computer Store Ltd. 44 Eglinton Ave. West Toronto, Ontario M4R 1A1 (416) 482-8080

The Computer Place 186 Queen St. West Toronto, Ontario M5V 1Z1 (416) 598-0262

Pacific Computer Store 4509-11 Rupert St. Vancouver, B.C. V5R 2J4 (604) 438-3282





# The Small Computer

Twenty-five years ago a computer as powerful as the new Processor Technology Sol-20 priced out at a cool million.

Now for only \$995 in kit form or \$1495 fully assembled and tested you can have your own small computer with perhaps even more power. It comes in a package about the size of a typewriter. And there's nothing like it on the market today. Not from IBM, Burroughs, DEC, HP or anybody else!

#### It fills a new role

If you're an engineer, scientist or businessman, the Sol-20 can help you solve many or all of your design problems, help you quantify research, and handle the books too. For not much more than the price of a good calculator, you can have high level computer power.

#### Use it in the office, lab, plant or home

Sol-20 is a smart terminal for distributed processing. Sol-20 is a stand alone computer for data collection, handling and analysis. Sol-20 is a text editor. In fact, Sol-20 is the key element of a full fledged computer system including hardware, software and peripheral gear. It's a computer system with a keyboard, extra memory, I/O interfaces, factory backup, service notes, users group.

It's a computer you can take home after hours to play or create sophisticated games, do your personal books and taxes, and a whole host of other tasks.

Those of you who are familiar with small computers will recognize what an advance the Sol-20 is.

Sol-20 offers all these features as standard:

8080 microprocessor — 1024 character video display circuitry — control PROM memory — 1024 words of static low-power RAM — 1024 words of preprogrammed PROM — built-in cassette interface capable of controlling two recorders at 1200 bits per second — both parallel and serial standardized interface connectors — a complete power supply including ultra quiet fan — a beautiful case with solid walnut sides — software which includes a preprogrammed PROM personality module and a data cassette with BASIC-5 language plus two sophisticated computer video games — the ability to work with all S-100 bus products.

#### Full expansion capability

Tailor the Sol-20 system to your applications with our complete line of peripheral products. These include the video monitor, audio cassette and digital tape systems, dual floppy disc system, expansion memories, and interfaces.

#### Write for our new 22 page catalog. Get all the details.

Processor Technology, Box G, 6200 Hollis St., Emeryville, CA 94608. (415) 652-8080.



"See us in Atlantic City"

AUGUST 1977 CIRCLE INQUIRY NO. 48 INTERFACE AGE 15



# THE JURISPRUDENT COMPUTERIST

### By Elliott MacLennon, J.D. Stephan Murtha

Some of you may have recently attended the West Coast Computer Faire, as we did, held in April at Brooks Hall in San Francisco. One of the things that impressed us with the exhibit was the vast number of people in this field who have, with varying degrees of success, taken some idea and turned it into a business venture. We later paused to wonder how many more ideas were out there, but did not make it to the Faire because of lack of information on the business and legal aspects of forming and running a successful enterprise. This column is an outgrowth of that observation.

There are two ways to make money on a good idea. Either you sell your idea or you sell the product or service which is the end product of that idea. The name of the game in selling your idea to someone else is to protect your rights, while at the same time divulging enough information to insure getting the best buyer at the best price. The next article in this column will deal specifically with patents, copyrights and trademarks as they apply to the field of computers. It is enough to say here that one must not only proceed with caution when seeking out someone to whom to sell your idea, but one must also proceed with an attorney.

If you decide to sell a product or service yourself, there are a number of questions which must be answered in order to determine how to set up your new business. The first question to answer is how big an undertaking are you considering? Can you do it yourself or do you need help? This question will partially determine how you will set up your business. If you can do it yourself then possibly a sole proprietorship would be appropriate, at least to start.

If you need help then you have some other considerations. Can you hire the help or will they have to share in the ownership of the business? Do you just need capital or do you need someone who can also wield a soldering iron? If you can hire help, then a sole proprietorship or possibly a corporation would be an appropriate form. If your help insists on a share of the ownership, then that is a different story, and a partnership or corporation is in order.

At this point let us briefly review the salient characteristics of sole proprietorships, and corporations from a tax and legal point of view. Basically, the interplay of taxes, legal requirements, and the nature of the business will determine the best form for the business to take. When dealing with small businesses there is no one form which is best for all businesses. The popular opinion that the sooner a business incorporates the better is misleading.

A sole proprietorship presents no real legal nor tax complexities. With the exception of some simple legal requirements such as registering with local or state government when operating under a ficticious name, etc., a person may operate as a sole proprietor with relative ease. He or she is liable for all debts and obligations incurred and creditors may reach to personal assets if business assets are insufficient. At tax time all income is reported, less allowable business expenses, as income to the sole proprietor and is taxed as ordinary income. Simplicity itself.

A partnership is slightly more complex. As with a sole proprietorship there are no real legal requirements which get in the way. However, this is often a hidden trap. The nature of a joint venture requires that all aspects of running the business, i.e. share of profits and losses, capital and work contributions, etc., be agreed on, preferably in writing. Since there is no legal requirement that this be done, many partnerships neglect this step, only to be torn apart later on by disputes. This point can not be emphasized enough. As both partnerships and

sole proprietorships cease to exist with the death or withdrawal of one of the owners, provisions should be made for this contingency. All partners are liable for all debts of the partnership and creditors may reach to personal assets. For tax purposes the partnership acts as a conduit for income and the partners report their share of the income on their tax returns. The partners may split income, capital contributions, work, and other items any way they see fit.

If outside capital is desired without giving up control, a variation called a limited partnership may be desirable. A limited partnership has one or more general partners, and one or more limited partners. A general partner has the same rights and responsibilities as a partner in a regular partnership. A limited partner is a partner who participates in the profits and losses, but does not share control or unlimited liability. Usually a limited partner is an outside investor who does not take part in the business operations. A limited partnership is governed by state and federal regulations which complicates matters.

The final form is the corporation. A corporation is very different from a partnership or sole proprietorship. It is governed by state and federal laws and even small corporations have all kinds of formalities and regulations having to do with everything from bookkeeping to voting procedure for directors to corporate minutes. Corporations are usually the most expensive type of business to form. Since it is an entity separate from the owners there are tax and accounting considerations which far exceed those of other business structures.

For all of these drawbacks the corporation has many advantages. Capital is usually easier to attract to a corporation. Shares are readily transferrable and easily divisible,

Vectored to page 22



Ohio Scientific's new Model 500 computer has full mini-computer BASIC in ROM and a minimum of 4K RAM for user programs. BASIC is always there when the computer is turned on.

#### Make your terminal intelligent!

If your company or school has remote computer terminals, consider the Model 500-1. It fits in the communications line between the terminal and modem or system. When the 500-1 is off, the terminal talks to the modem. When it is on, the terminal talks to the Model 500. Use the Model 500 for short and medium sized programs in BASIC. Use its immediate mode as an ultra-powerful scientific calculator!

#### **Computers for Students**

Couple a Model 500 to a low cost purchased or leased terminal such as the popular ASR-33 teletype for student instruction. The Model 500's BASIC is a perfect instructional language for students. dents. Since the computer's machine code is also accessible, the Model 500 can challenge the advanced student with other optional software such as our interactive Assembler/Editor.

#### **Personal Computing**

The Model 500 has eliminated all of the grief of the first generation personal computers. This computer comes fully assembled, tested, and guaranteed.

Most importantly, it is easy to use since the BASIC is always

#### Flexibility and Expandability

The Model 500 uses Ohio Scientific's standard 48 line bus so that it is fully compatible with our Model 400 kits and Challengertm product lines. Any of thirteen accessory boards including RAM, PROM, parallel, serial, A/D, D/A, cassette, and video graphics can be added as well as peripherals including floppy disks, line printers, color graphics, and more.

The Model 500 is offered here in three forms to meet every

application and pocket book.

#### **Specifications**

#### \$298.00 Model 500 Board

8" x 10" fully assembled board including 6502 microprocessor running at 1MHz, 512 bytes of PROM, 8192 bytes of ROM containing 8K BASIC and 4096 bytes of RAM for user programs. The board contains an ACIA based serial interface which is jumper selectable for RS-232C or 20ma loop at 110, 300, 1200, 2400, or

The 8K BASIC features: full floating point math including transcendental functions, N dimension arrays, multiple letter

variables, full string functions, logical operators, PEEK, POKE, USR, and lots more!

The Model 500 board requires +5 volts at 2 amps, -9 volts at 500ma, an external reset switch, and an ASCII serial terminal for operation.

#### Model 500-1 \$429.00

Fully enclosed 500 board with power supply, reset switch, and two 25 pin EIA standard terminal connectors for loop through operation. The 500-1 is 12" x 15" x 4".

#### Model 500-8

This unit is a 500 board in an eight slot Challenger<sup>Im</sup> case allowing seven slots for expansion. The unit has a heavy-duty UL recognized power supply and is 15" x 17" x 10".

#### **ORDER FORM**

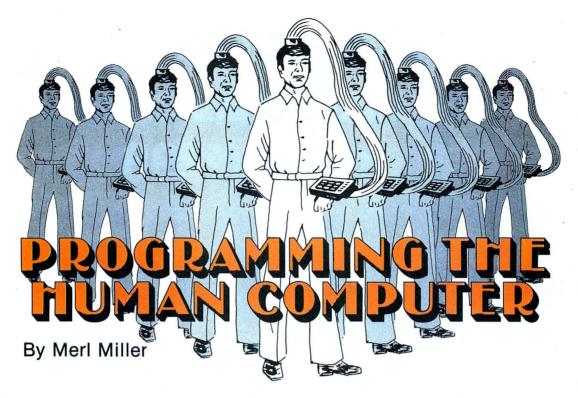
| Order directly from:<br>Ohio Scientific; Hiram, Ohio 44234<br>This introductory offer expires August 3'<br>for delivery. | 1, 1977. Please a | llow up to 60 days |
|--|-------------------|--------------------|
| PRINT OR TYPE CLEARLY.   |                   |                    |
| Name   |                   |                    |
| Shipping Address   |                   |                    |
| City   | State             | Zip                |
| Payment by: BAC (VISA) MC Mo   | ney Order         |                    |
| Credit Card Account #  | Expires           |                    |
| Interbank # (Master Charge)  |                   | 3                  |
| Model 500 Boards @ \$298.00  |                   |                    |
| Model 500-1 Computer @ \$429.00  |                   |                    |
| Model 500-8 Computer @ \$629.00  |                   |                    |
| Additional 4K RAM Memories   |                   |                    |
| for 500-8 @ \$149.00   |                   |                    |
| 4% Sales Tax (Applies to Ohio Residents only)  |                   |                    |
| TOTAL CHARGED OR ENCLOSED  |                   |                    |
| All orders shipped insured UPS unless ot   | herwise requeste  | ed.                |

"See us in Booths 218 & 219 in Atlantic City"



"And see us in in Boston"

Booths 314 & 319



It is the most technologically advanced device ever created. In its fully developed form, it is usually from 150 to 200 centimeters long, 45 to 90 centimeters wide, 15 to 30 centimeters thick, and weighs between 50 and 100 kilograms. Its size can vary considerably from these parameters and it will still function effectively. Its power supply is selfcontained and it can often go for long periods of time on a single charge. Prototype models are always smaller and generally have a length of 40 to 60 centimeters with a weight of 3 to 4 kilograms. The computer is placed on the top of the system in a manner that allows it to monitor the entire system easily and efficiently. The controller, CPU and memory devices are contained on a single chip consisting of billions of circuits. It is easily programmed given the right set of circumstances.

It is called a human being.

We are going to talk about developing the right set of circumstances for programming the human computer. Specifically, we shall concentrate on how to acquire information and how to pass it on to others. Later on I will give you a list of topics that we can cover, but let's discuss the basic concept first.

Information transfer, learning theory, or whatever it is called, has been studied and analyzed since the days of Socrates; however, no one has ever been able to determine how or why people learn. Much is known about how to motivate learning, but learning itself is still somewhat of a

mystery. Unfortunately, the more educators know about learning, the more obtuse they become; consequently, the best teachers are those who stick to the basics.

That which most concerns you is how to motivate your own learning, especially how to learn about computing. This means that we shall have to stick to the basics: for instance, when I describe courses given at computer stores, I'll start by giving you an outline of a specific course. I will amplify the outline by telling you which sections are liable to give you trouble, what kinds of things you should expect to learn from the course, what materials you should take with you, what you should study before taking the course, what it costs, etc. In other words, a general introduction to what the course is and how to get the most out of it.

This brings up an important point. Your input into this process is crucial. The list of topics that can be covered in a column like this is almost endless, so we must concentrate on what you want to know. You can help by telling me in what you are interested. A single line on a postcard may be sufficient. Answering some of these questions should get you started. What do you want to know? Why do you want to know it? From whom did you learn it? What kind of success have you had with self study? Why was it successful?

While you are thinking about your list of topics, I'll give you mine. The topics listed below are general in-

terest areas. Each one can represent two or more columns:

How to get your book published. General survey of microcomputer courses.

How to get the most out of a programming manual.

How to read manufacturer's literature.

How to start a course in your club or store.

How to prepare a talk at a conference.

How to get the most out of a computer book.

How to read a computer magazine. How to write an article for a magazine.

That's a start. The list is not meant to be complete and we may decide to be quite specific at times. We could discuss learning how to convert binary to hexadecimal in your head while pretending to be awake during a long lecture at a computer conference.

At the end of each column, I will give you a little preview of coming attractions. We are going to discuss book publishing first because that is the subject about which I know the most. Next month we shall take our first look at how to get your book published. I will give you some "how-and-what" guidelines. That is, how to submit material and what to submit.

That's it for this month, thank you for reading this far.

# Building a better computer wasn't easy. But we did it.

#### Introducing the MSI 6800 Computer System

When we set out to build the new MSI 6800 Computer System, we knew we had our work cut out for us. It had to be at least as good as the now famous MSI FD-8 Floppy Disk Memory System which is also pictured below. So, the first thing we did was analyze all the problems and drawbacks we had encountered with other 6800 systems, and then put our engineers to work on solutions. The objective: Build a better computer.

We started with power supply. We had big ideas, so we used a hefty 18 amp power supply. You can run full memory and several peripherals without the worry of running out of juice. We also put it in the front of the cabinet so it's out of the way.

The next step was the CPU Board. A separate baud rate generator with strappable clock outputs allows any combination of baud rates up to 9600. A separate strappable system clock is available and allows CPU speeds of up to 2 MHz. The new MSI monitor is MIK-BUG software compatible, so you will never have a problem with programs. Additional PROM sockets are available for your own special routines and to expand the monitor. The CPU also contains a single step capability for debugging software.

To complete the system, we used an MSI 8K Memory Board which employs low power 2102 RAM memory chips and is configured to allow battery back-up power capability. A DIP switch unit allows quick selection of a starting address of the board at any 8K increment of memory.

If you're one of those people who understands the technical stuff, by now you'll agree the MSI 6800 is a better computer. If you're one who does not un-

derstand it yet, you'll be more interested in what the system can do . . . play games, conduct research and educational projects, control lab instruments, business applications, or just about anything else you might dream up that a microcomputer can do. The point is . . . the MSI 6800 will do it better.

The MSI 6800 Computer System is available in either kit form or wired and tested. Either way, you get a cabinet, power supply, CPU board, Mother board, Interface board, Memory board, documentation, instructions, schematics, and a programming manual. Everything you need.

There is more to say about the MSI 6800 than space permits. We suggest you send for more information which includes our free catalog of microcomputer products.



When we got to the Mother Board, we really made progress. It has 14 slots to give you plenty of room to expand your system to full memory capability, and is compatible with SS-50 bus architecture. Heavy duty bus lines are low impedance, low noise, and provide trouble-free operation.

With all this power and potential, the interface had to be something special. So instead of an interface address in the middle of memory, we put it at the top... which gives you a full 56K of continuous memory. Interfaces are strappable so they may be placed at any address. An interface adapter board is compatible with all existing SS-50 circuit boards and interface cards. All MSI interface cards communicate with the rear panel via a short ribbon cable which terminates with a DB-25 connector. All baud rate selection and other strappable options are brought to the connector so they may be automatically selected by whatever plug is inserted into the appropriate interface connector. Straps may also be installed on the circuit board.

Building a better computer was not easy. Becoming the number one seller will be.

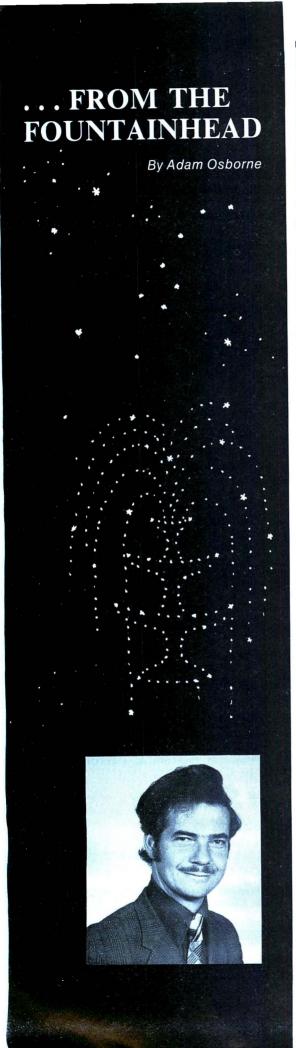
See the MSI 6800 Computer System at Personal Computing '77 - Atlantic City.

#### Midwest Scientific Instruments

220 West Cedar • Olathe, Kansas 66061 913/764-3273 • TWX 910 749 6403 (MSI OLAT)

|        | 910/1010210 111111910 119 0100 (1101 02111)                          |
|--------|--|
|        | 0000000000000000000000000  |
|        | Midwest Scientific Instruments<br>220 W. Cedar, Olathe, Kansas 66061 |
| 000000 | NAMEADDRESS CITY STATEZIP  |

AUGUST 1977 CIRCLE INQUIRY NO. 33 INTERFACE AGE 19



Mr. Murray Gallant of E&L Instruments, Inc. has written a letter challenging remarks I made in the June issue regarding the economics of selling unassembled boards to microcomputer kit buyers. I believe it is only fair that readers see Mr. Gallant's letter in its entirety — therefore, here it is:

Mr. Robert Jones Publisher & Editor-In-Chief Interface Age Magazine 13913 Artesia Blvd. Cerritos, CA 90701

22 June 77

Dear Mr. Jones:

While I feel that most reputable microcomputer manufacturers will simply laugh at Mr. Osborne's naivety in his recent column (June '77) when he sweepingly indicts all of us for our shoddy parts, QC and general inattention to customers, we at E&L are concerned enough to make an effort to clear up some gross misstatements made by the author concerning kits and assembled/ tested units.

- 1. If Mr. Osborne believes he can assemble and test a microcomputer board for \$3.00, I suggest he not go into the business as he will instantly lose his investor's money. If he uses out of pocket cost for someone who assembled the parts in his basement as his basis for this statement, he has not thought things through. It is not unreasonable to assume that every hour of manufacturing time has to be compensated at over \$10.00 per hour to cover manufacturing overhead and direct expenses. If he believes that it takes less than an hour to assemble 20 to 40 IC's on a board then again he is talking without a knowledge base.
- 2. We know not what course other manufacturers take, but we 100% inspect our prime chips whether used on assembled units or kits. These include, of course, the CPU's, PROM's and RAM's. We sample the balance and reject all lots with more than a very limited failure rate (under 1%). We 100% check our transformers. We visually inspect all our PC boards. We totally reject his contention that the kit builder gets a bag of untested parts and let the devil take the hindmost. Since we build our assembled units from the same parts, we cannot afford to burden ourselves with poor quality parts which cause excessive checkout/QC problems or field difficulties.
- 3. We aren't hard nosed about "defective" parts . . . we accept the fact that in the ways of the world, IC's die out in the field, whether through customer error or through material means. We specifically include IC sockets on all our kits so we won't get into petty fights with our customers over "who did what to whom." It is very rare that we charge for these replacement parts if the customer indicates that the IC was received bad. In the rare event we do get a unit back here (yes, Virginia, even E&L gets a few back), we make it a point to give the customer the benefit of the doubt and not charge for kit repairs unless the

fellow soldered with a warm rock and hammered the IC's into the sockets.

I think Mr. Osborne should be taken to task, not for any single thing he reported, but because he generalizes on insufficient data about a limited group of "Fly by Night" storm door and computer companies. He is in a position to call such inadequacies to the consumer's attention and should do so, but not by painting us all with the same muddy brush. I trust he will think about this and try to itemize his grievances in the future.

Very truly yours, E&L INSTRUMENTS, INCORPORATED Murray Gallant President

Despite Mr. Gallant's letter, I will take back very little of what I said. The only point I will give in on is any sweeping statement that "all" kit manufacturers are guilty of any sin. Clearly this is not the case. It does not matter how widespread a bad business practice may be, you are going to find a few companies who are exceptions to the rule. I would like to note, before rebutting Mr. Gallant, point by point, that E&L Instruments is one of the very few companies concerning whom we have never had a critical telephone call, but concerning whom we have had a few telephone calls of praise. It is unfortunate that someone at a company of E&L Instruments' calibre chose to reply my column; but those who knew what I said was generally right would refrain from rebutting for fear of the consquences.

Let us take Mr. Gallant's comments point by point.

It costs approximately \$3.00 to assemble and test a microcomputer board — providing you have your own in-house flow soldering production facilities.

I am not the one who is naive on this subject, Mr. Gallant is. I know of enough companies with in-house fabrication facilities to be quite certain of this figure. If a small manufacturer takes boards in low quantity (a hundred at a time or thereabouts) and has them assembled by a contract assembly house, then the cost is likely to be between \$9.00 and \$14.00 per board. Many of the companies I know who assemble inhouse are smaller than the larger microcomputer manufacturers. I claim that the larger microcomputer manufacturers, and perhaps E&L Instruments, are the ones that have not done their homework and are wasting money jobbing out an assembly process which could be done in-house.

Let us now turn to the second and third paragraphs of Mr. Gallant's letter; they are really related.

What Mr. Gallant claims to be doing (and I have absolutely no reason to disbelieve him) represents the



Micromation's MACRO DISC is a complete, high performance floppy disk system—yet it's economical.

#### **Fast Per-Sci Drive**

MACRO DISK uses the unique Per-Sci dual drive to give you the fastest, most reliable system available. This unique drive features a fast voice coil positioner and automatic electronic diskette handling. It's a field-tested design that's proven its reliability and superiority in years of operation. And its a full-sized dual drive—you have on-line mass storage of over 500K Bytes, and you can copy diskettes to provide essential system backup.

#### **IBM Compatible Controller**

The Micromation disk controller features full IBM 3740 formating—so you can interchange disks with the rest of the world. There's even a serial I/O port on the controller board to make it easy to bring the system up. Just connect your terminal to the controller's serial interface, install in any 16K S-100 system, jump to the on-board PROM bootstrap—and you're up and running without any patching.

#### A Complete, Assembled System

MACRO DISK is fully assembled and tested. And it's complete—including aluminum enclosure, cables, power supply, and fan. Everything you need

to bring big system performance to your S-100 computer.

#### Powerful CP/M Software—and BASIC

For program development select the optional Micromation version of CP/M, the most powerful floppy disk operating system available for microcomputers. And there's BASIC. A complete disk BASIC featuring: versatile file access; string processing; and both numeric and string arrays.

#### Under \$2,000 Systems

The fast Per-Sci drive, the IBM compatible controller, and the powerful CP/M software make MACRO DISK a high performance system. And since MACRO DISK uses proven, standard components, there's no long wait for delivery. Systems are available in less than four weeks from receipt of your order. But the best news is the price.

| the best news is the price.           |          |
|---------------------------------------|----------|
| MACRO DISK dual Disk system           | \$1,895. |
| CP/M with BASIC                       | 95.      |
| <b>Complete Documentation Package</b> | 35.      |
| (refundable with order)               |          |

Ask about MACRO DISK at your computer store, or write or call for additional details. Micromation Inc., 524 Union, San Francisco, Ca. 94133, (415) 398-0289.

MICROMATION

"See us at Booth 105 in Atlantic City" highest standards of industry practice. E&L Instruments inspects all chips, then sells inspected devices, together with sockets; thus they endeavor to reduce failure rates. The few customers who request replacements for defective parts are supplied with these parts, no questions asked. The E&L Instruments scenario seems to be the ideal one; but now let's see how it applies to the majority of microcomputer kit manufacturers.

At the present time it is the rule, rather than the exception, that a kit manufacturer will send you a replacement for a part which you claim is defective. The reason for this open-handed policy is that there are relatively few requests for replacements; kit builders tend to assume that the fault is theirs, so they buy a replacement part. So long as the number of requests for replacements is small, it is economical for a manufacturer to simply send out another part. The alternative is to have in-house staff who will spend the time qualifying individual requests for replacements of parts which might only cost a few dollars. If the requests for replacements achieve any significant volume, however, kit manufacturers are likely to change their ways - since the cost of replacement parts might become a significant contributor to overall product costs. At that time kit manufacturers will be forced either to increase their prices and maintain their liberal replacement policies, or maintain their prices and adopt tougher replacement policies. The problem on the horizon is that some kit buyers themselves have not proven to be totally honest. The early collapse of the microcomputer software industry was based entirely on the hobbyists' propensity to steal software, rather than to pay for it; and it is naive to assume that kit buyers will be any different when it comes to hardware. It is conceivable that an epidemic of part defects will occur, which in reality will be kit buyers obtaining free duplicates for parts that never failed in the first place. At the moment there is no indication that this is occurring, but should it occur, kit manufacturers had better be organized to handle the problem.

When it comes to testing parts before shipping them, many kit manufacturers I have spoken to claim that it is a waste of effort to test parts that they are going to replace on demand. Why bother spending the money testing for the few failures you are likely to get from the semiconductor manufacturer? These kit manufacturers no doubt will start testing their parts if they cease to be so liberal in their replacement policies.

At the present time the average kit builder does get a bag of untested parts and let the devil take the hindmost. E&L Instruments represents the exception, not the rule.

On Mr. Gallant's last paragraph I will simply offer an apology. I did not intend to paint all kit manufacturers with the same muddy brush and Mr. Gallant has every right to be annoyed if he read his own company into the article. I restate I have had telephone calls praising E&L Instruments; I have had none criticizing them. Considering how few people ever bother to write or telephone with praise, and how quick they are to write and telephone with criticism, this speaks very highly of E&L Instruments.

I would appreciate further comments from kit buyers regarding the problem of untested parts and part replacement. I believe future kit manufacturers' policies may not be the same as they have been in the past and perhaps users can express

their interests and concerns through this column. (My telephone number is 415-548-2805).

On a recent flight, I met Mr. James Page of Walnut Creek, CA. Mr. Page works for the telephone company and is ready to become a computer hardware-owning hobbyist (if he has not already done so). Mr. Page is a good example of the suited-to-marry technologies-telecommunications and microprocessors - in order to develop consumer products that are immediately useful in every household that has a telephone. Mr. Page gave me three ideas, none of which I shall repeat since each one on its own is worth a fortune as a product. I believe there are a large number of similar hobbyists throughout the country, all of whom have excellent ideas, but assume that implementing them is pointless since somebody else has already done it. Let me simply state that right now the chances are nobody else has done it; and even if they have, you may do it better or do it right. I personally know many of the individuals who started successful companies in the minicomputer industry during the late 60's. Most of these individuals are successful today simply because they did it. My message to the hobbyists is the same: "do it." You may just be surprised how close at hand success is. But do not simply take an idea to a company and expect to be showered with money; you must first have a working model. Then you can acquire capital to build it yourself, or you can try to sell the product to a company that will build it for you. Of course, here is where business acumen is important. Do not assume that you will be offered a fair deal. If you do not trust your own financial mind, interest a local management consultant or CPA in working with you during any product or financing negotiations.

#### JURISPRUDENT COMPUTERIST

#### Branched from page 16

which makes it more accessible to a larger number of investors. However, state and federal regulations govern the sale and transfer of shares in even the smallest corporation and must be considered. Since a corporation is a legal entity, separate from its owners, the owners are not legally liable for the debts of the corporation. However, in practice, lenders will usually require credit to be secured by both corporate and personal assets, so this is usually a moot issue. Finally the separation of owners and business in a corporation often leads to very desirable tax advantages.

The choice between a sole propri-

etorship and a partnership is usually based on the number of principals involved in the business. The choice between one of these forms and a corporation is one which should be made with the help of an accountant, attorney, and pension and insurance advisor, since the factors influencing this decision are complex.

The time and money invested in weighing all of these factors and securing the proper counsel may seem onerous, but will be returned many times over if these decisions are made early in the planning of your business. It will relieve you from needless grief and worry and free you up to make your business venture a success.

ELLIOT MACLENNON J.D., has his degree in legal rhetoric from the University of California at Berkeley and his law degree from Hastings Law School. He is a senior partner in the firm MacLennon and Lillie, Walnut Creek.

STEPHEN MURTHA has his degree in finance and accounting from the University of California at Berkeley. His firm, D/A Associates, Orinda specializes in business and estate planning for owners of small business.

#### DISCLAIMER:

The information given here is necessarily general. The authors and publishers take no responsibility for its applicability to specific situations. You should consult your attorney for specific information.



In-depth information through seminars, lectures and workshop sessions covering the personal computer field.



OSBORNE AND ASSOCIATES, INC.

"MICROPROCESSORS — WHERE THEY ARE THEY ARE THEY ARE THEY FROM AND WHERE THEY PRODUCED OF ALL PRODUCTS ON THE MARKET TODAY."

OF Adam Osborne will present a 6 hour of the propulation of UCTS ON THE MARKET TUDAY. 6 hour Dr. Adam Osborne will present a Bringing topics such as; are not seminar covering topics such as; are not order out of chaos; All microprocessors are than order out of chaos; one market better than order out of serves one market better order out of chaos; All microprocessors are not than each serves one market better best equal—each serves one markets have other; Identifying those markets sales the other; each microprocessor; Comparisons insuited to each microprocessor; Comparisons involume anticipated for 1977; Comparisons involume anticipated for 1978; F8, Etc. volume anticipated for large each contact cluding; 8085 vs. Z80, 8048 vs. F8, Etc. contact: cluding; 8085 vs. Z80, 8048 vs. F8, Etc.

Contact:

PC77,

For information and reservations PC77,

Soborne and Associates Inc., 94702 (415)

Osborne 2036, Berkeley, CA 94702

PO Box 548-2805.

TYCHON, INCORPORATED

August 24, 25 & 26

3 DAY MICROCOMPUTER INTERFACING WORKSHOP 3 DAY MICROCOMPUTER INTERFACING WORKSHOP A hands on experience for the participants where they will spend almost 50% of their time working on well documented interfacing and Software experiments. Students deal with the microcomputer at the bijs level. interfacing the computer using solderless ing and Software experiments. Students deal with the microcomputer at the bus level, interfacing the computer using solderless breadboarding techniques and assembly language programs. Presented by Jonathan A. Titus and Dr. Christopher A. Titus, For information and "BUGBOOKS." Christopher A. Titus, Shortness-Rawson, Dept. PC77, P. O. Box 2203, South Hacken-

SYBEX INCORPORATED
Thursday, August 25 & Sunday, August 28 INTRODUCTION TO MICROPROCESSORS

This intensive seminar is intended for all non-specialists who wish to ac-INTRODUCTION TO MICROPROCESSORS This intensive seminar is intended for all non-specialists who wish to acquire a broad understanding of the basic concepts and advantages of microprocessors. It explains how microprocessors work and it stresses and disadventages for the most important methods, costs adventages and disadventages for the most important. microprocessors. It explains how microprocessors work and it stresses and disadvantages for the most important methods, costs, advantages and disadvantages for the most important methods, costs, advantages and disadvantages for the most important methods, costs, advantages and disadvantages for the most important methods. methods, costs, advantages and disadvantages for the most important application areas of each type of microprocessor. What is needed to implement a system, how to use it she increase. application areas of each type of microprocessor. What is needed to implement a system; how to use it; the impact on microprocessor-based systems; their evolution. Topics covered include: BASIC DEFINITIONS, SYSTEM COMPONENTS, MICROPROCESSOR APTIONS, WHAT TO LOOK FOR, and IMPACT AND EVALUATION.

EVALUATION.

PROGRAMMING MICROPROCESSORS

PROGRAMMING MICROPROCESSORS

This seminar describes in detail the internal operation of a internal operation of a microprocessor system including how instructions are fetched and executed, how programs are written and executed in typical cases (extend how programs are written and executed in typical cases) are written and executed in typical cases (extend how programs are written and executed in typical cases) are written and executed in typical cases (extend how programs are written and executed in typical cases). (arithmetic and input-output). The goal of this course is to provide an overall understanding of the basic concepts of microprocessor programoverall understanding of the basic concepts of microprocessor programming. Requires an understanding of the main concepts in the IN-TRODUCTION TO MICROPROCESSORS course. It is recommendable to the state of the sta

ed that these two seminars be taken together.

Friday, August 26

MICROPROCESSOR APPLICATIONS This seminar presents in detail the main application techniques of microprocessors Topics covered include INTRODUCTION TO MI This seminar presents in detail the main application techniques of microprocessors. Topics covered include INTRODUCTION TO MI. TECHNIQUES, APPLICATION TECHNIQUES, APPLICATION TECHNIQUES, CROPROCESSOR SYSTEMS, APPLICATION TECHNIQUES, CASE STUDIES (industrial applications, medical and business applications, microprocessors in the home. and others). and EVOLUTION. cations, microprocessors in the home, and others), and EVOLUTION. cations, microprocessors in the home, and others), and EVOLUTION.

For information and reservations contact: Sybex Inc., 2161 Shattuck

Ave. Rarkeley, CA 04704 (415) 949, 9923 FOR INDEFINATION and reservations contact Ave., Berkeley, CA 94704 (415) 848-8233.

#### TECHNICAL DESIGN LABS AND TRENTON STATE COLLEGE August 22 through 26

PROGRAMMING IN BASIC FOR THE uC OWNER.

An introduction to the Basic language. From beginning to writing application programs. Emphasis on TDL's 8K and 12K Basic for the Z80. Includes intro to TDL's ASSEMBLY LANGUAGE PROGRAMMING FOR THE Z80/8080

An introduction to assembly language programming. First covers 8080 instructions and then branches into the extra instructions available for the Z-80. Includes intro to TDL's Z-80 Monitor and Macro-Assembler and also covers applications in interfacing

ADVANCED ASSEMBLY LANGUAGE PROGRAMMING FOR THE Z-80.

For someone who knows the 8080. Covers added Z-80 instructions and how to get the most out of them. Emphasis on use of TDL's Macro-Assembler. Application to digital logic replacement and process control. FORTRAN IV

An introduction to the FORTRAN language. From beginning to writing of application programs. Emphasis on TDL's ANSI standard FORTRAN IV for the Z-80.
WORD PROCESSING WITH A TEXT EDITOR AND FORMATTER

Introduction to the use of the Text Editor and Text Output Processor for achieving basic word processing capabilities. Emphasis on TDL's Text Editors and Text Output Processors. Familiarization with system requirements. INTRODUCTION TO HOBBY COMPUTING

survey course dealing in an exploration of the Hobby computing field and defining the basics needed to be understood in order to get started. DIGITAL LOGIC CIRCUITS

Instruction in digital logic circuits covering the 7400 TTL and the CMOS series. Codes, registers, counters, memory, combinatorial logic, etc.

Guest lectures from owner/operators of computer stores and microcomputer manufacturers. How to become a dealer. How to get a franchise. How to operate a business. How to set up a service facility . . and more.

Instruction and guidance on kit building. Bring your kits! SPECIAL: Anyone taking delivery on a TDL product during the course (must be ordered in advance) will receive this workshop FREE.

For information and reservations contact: Z-80 Seminars, Office of Continning Education, Trenton State College, Trenton, NJ 08625.

OSBORNE ASSOCIATES, SYBEX AND TYCHON SEMINARS ARE ALL HELD IN THE SHELBURNE HOTEL, ATLANTIC CITY, NEW JERSEY. TECHNICAL DESIGN LABS AND TRENTON STATE COLLEGE SEMINARS ARE HELD AT NEARBY TRENTON STATE COLLEGE, TRENTON, NEW JERSEY.

**INTERFACE AGE 23** AUGUST 1977

# COME TO PC '77 ... Atlantic City, New Jersey August 27 and 28, 1977

PC '77 offers you the most complete show of its kind ever held. Proven in '76 and acclaimed in '77 by all the major professional publications as the coming event of the year, this show is a 'must'. Make plans now to attend. Here are some of the scheduled events:

#### PRE-CONVENTION PROFESSIONAL SEMINARS

August 22-26 Technical Design Labs and Trenton State College Z80 Seminars at nearby Trenton State College.

Five software and four hardware seminars.

August 25, 26, 28 SYBEX Seminars at the Shelburne Hotel. Three intensive seminars: Introduction to Microprocessors, Programming Microprocessors, Microprocessors Applications.

August 24, 25, 26 TYCHON INC. Microcomputer Interfacing Workshop at the Shelburne Hotel.

August 26, 27 Osborne & Associates Microprocessors — Where they came from and where they are going, an analysis of all products on the market today. At the Shelburne Hotel.

#### MORE NEW PRODUCTS THAN EVER!

All the products you've been reading about in the ads will be on display at PC '77. Many companies will be showing exciting new products. HEATH COMPANY will display exclusively, for the first time, their complete computer line. SOLID STATE MUSIC, POLYMORPHIC SYSTEMS, THE DIGITAL GROUP, THOMAS INSTRUMENTATION, MOS TECHNOLOGY, TECHNICAL DESIGN LABS, SOUTHWEST TECHNICAL PRODUCTS, CROMEMCO, E & L INSTRUMENTS, THE INTERPRING GROUP, KENT-MOORE INSTRUMENTS, PERSCI INC, GEORGE RISK INDUSTRIES, MID WEST SCIENTIFIC, OSBORNE AND ASSOCIATES, EX-PANDOR, QUAY CORP, MATRIX PUBLISHERS, CAMELOT PUBLISHING CO, HAYDEN BOOK CO, GAW ELECTRONICS, ENCLOSURE DYNAMICS AND SOROC TERMINALS will all be showing new products. Plan to attend!

#### **OUTSTANDING COMPUTER HOBBYIST OF THE YEAR AWARD**

This is an annual award presented to a person who has given outstanding service to others in the personal computing field with no commercial motives. Nominations are currently being accepted from individuals and clubs.

For an interesting evening of family entertainment, plan to attend the Ice Capades which are in town the week of PC '77.

LET'S KEEP THE PERSONAL IN PERSONAL COMPUTING!

24 INTERFACE AGE AUGUST 1977



## Deal yourself in™ on the biggest personal computing show of the year!

#### SEMINARS, FORUMS, TECHNICAL TALKS

SATURDAY NIGHT BANQUET OUTSTANDING SPEAKERS. Tickets are limited, first come, first served.

> Thousands of dollars worth. You may be a lucky winner!

Session of the Pro-posed National Organ ization of Computer Clubs chaired by Sol Libes of the Amateur Computer Group New Jersey and Richard Kusmack of Chesapeake Microcomputer Club.

ENIAC by Dr. John Mauchly, the co-inventor of ENIAC PROGRAMMING ENIAC by Mrs. John Mauchly

SAM 76 by Claude Kagan of Western Electric Co., an interactive symbol system manipulations

system which grows with the user. TELECOMMUNICATIONS FROM THE TERMINAL USER'S VIEWPOINT by David L.

Peters of Vadic Corp INTRODUCING THE HEATHKIT COMPUTER PRODUCTS by Lou Frenzel of Heath

HOW MICROPROCESSORS ARE DESIGNED by Will Mathys of MOS Technology

THE FUTURE OF MICROS IN MEDICINE by Dick Moberg, Dept. of Neurosurgery, Jefferson Medical College, Philadelphia

THE HUMAN FACTOR by Andrew Singer of ROM Magazine

SHOULD MICROS BE USED FOR BUSINESS APPLICATIONS? by Frank J. Ponzio, Jr., of Mini Computer Suppliers, Inc.

ROBOTS by Tod Loofbourrow, author for Interface Age Magazine

GETTING INTO THE MICRO COMPUTER BUSINESS by Robert S. Jones, publisher of Interface Age Magazine

MUSIC FOR THE HOBBYIST, HARDWARE AND SOFTWARE by Malcolm Wright of Solid State Music

HAM RADIO APPLICATIONS by Dr. Robert Suding of the Digital Group HANDICAPPED SYMPOSIUM by Dr. Robert Suding of the Digital Group HOME MANAGEMENT SYSTEMS by Dr. Robert Suding of the Digital Group

FLOPPY DISK by Herbert G. Waite of PerSci Inc. INTERFACING A HOME SELECTRIC by Charles Yates of Amateur Computer Group of

MOVING UP TO AMATEUR RADIO by Chod Harris of the American Radio Relay League OPERATING THROUGH AMATEUR SATELLITES OSCAR 6 AND 7 by Gary Tater

W3HUC of AMSAT THE PHASE III MICROPROCESSOR CONTROLLED AMATEUR SATELLITE by Tom

Clarke WA3LND and Jan King W3GEY of AMSAT MICROPROCESSOR APPLICATIONS FOR RADIO AMATEURS by Kasser G3ZCZ of

AMSAT WHAT PEOPLE ARE NOT GOING TO DO WITH HOBBY COMPUTERS by Stephen

Gray of Creative Computing
APPLICATIONS OF MICROCOMPUTERS: THE MYTH AND THE REALITY by David Ahl of Creative Computing

INTRODUCTION TO COMPUTERS THROUGH THE BASIC LANGUAGE by Eri Golembo of Computer Mart of New Jersey

DYNAMIC DEBUGGING SYSTEM FOR THE 8080 CODE by Larry Stein and David Benevy of Computer Mart of New Jersey

MICROPROCESSORS FOR THE HOBBY MARKET TODAY AND TOMORROW by Dr. Adam Osborne of Osborne and Associates

GETTING STARTED WITH MICROCOMPUTER SOFTWARE by Dr. Christopher A. Titus, author of the Bugbooks

COMPUTERS AND MUSIC by Carl Helmers of BYTE Magazine

PRE-REGISTER! FILL OUT AND MAIL THE COUPON ON BACK PAGE!

Register before August 10 SAVE 20%

# PC'77NEWS

In-depth Seminars, lectures, presentations!

Silicone Sea ... There's a new excitement in Atlantic City. With the advent of casino gambling \$800,000,000 is being invested by such companies as Caesar's International, Playboy, Penthouse, Bally Corporation, Resorts International, Loew's Corporation and many others in new hotel, restaurant and entertainment facilities. And of course all the old attractions of this famous resort remain, the miles of sandy beach with gentle surf, the clean, well run amusement parks, the boardwalk with its exotic shops and much more. All of this adds up to the perfect family vacation spot, easily reached in less than two hours driving time from Washington DC, Philadelphia or New York City.

There is parking for 20,000 cars within a three block area of convention headquarters. The convention hotel is right on the boardwalk. Hotel parking is for hotel guests only. Others park on near-by Pacific Avenue.

Club Booth ... Every computer club is welcome to participate with us at PC 77 at our gigantic club booth. Clubs may have members manning the booth to engage in non-commercial activities such as meeting new people from their areas, giving out club literature, newsletters, membership forms and signing up new members.

Dr. John Mauchly and ENIAC ... Enthusiasts will have a chance to meet one of the earliest pioneers of the computer industry. Dr. John Mauchly, conventor of ENIAC, the first electronic digital computer, will be a featured speaker and guest at PC 77. Dr. Mauchly will be telling the inside story of the trials and tribulations, as well as the triumphs, of ENIAC. And remember, all of this was going on during World War II! Accompanying Dr. Mauchly will be Mrs. Mauchly who worked on the project as one of the original woman computer programmers. Dr. Mauchly, who is an active home computerist, will be available to speak informally with hobbyists during the convention. Don't miss this!

Club Hospitality Suite ... The Amateur Computer Group of New Jersey, Northern New Jersey Amateur Computer Group, Philadelphia Area Computer Society and the Chesapeake Micro Computer Club will host a hospitality suite during the show. Representatives of all computer clubs are encouraged to drop by the suite during the show to exchange views, greet old friends and meet new ones.

SPECIAL GROUP TRAVEL RATES ... for Clubs and Organizations from West Coast and Mid America. Contact Seven Seas Travel, 17220 South Norwalk Bldv., Cerritos, Calif. 90701, Dawn Corrigan, 213/924-8383.

Helpful Hints for Getting the Most Out of the Show

1. Make a list of the companies that you particularly want to see.

2. Bring pregummed address labels with your address printed on them for exhibitor questionnaires, booth prize tickets and requests for information. This will save having to write your name hundreds of times and give you more time to get around the show.

3. Plan on returning to your room or car several times during the day to drop off literature and to change into a fresh pair of comfortable shoes.

4. Bring a good tape recorder, lots of spare batteries and tapes and record information, make notes, and record the seminars. (Recording of seminars is for personal use only, reproduction is prohibited.)

5. If you are planning to attend only one day, make that day Saturday. If you find you really need more time you'll be able to come back on Sunday.

6. Make hotel reservations early. Have them confirmed to save both time and disappointment.

7. Bring spare pencils, pens, and note paper.

8. Bring adequate identification in order to make purchases.

9. Be open minded when talking to exhibitors. Listen to what they have to say, you may learn something valuable.

10. Bring your camera, there will be much to photograph.

11. Remember that advance registration will save you from having to wait in line. Mail the coupon below to-day!

| PC '77 Weekend admission at the door will be \$10.00. 20% AVOID WAITING IN LINE! Admission includays, August 27-28th. | Register before August 10th SAVE udes exhibits and seminars for both |
|---|--|
| Please rush advance registration tickets for  | r August 27-28th at \$8.00 each.                                     |
| Please rushBanquet tickets for Saturday, A  | August 28th at \$17.50 each.   |
| Please rush Banquet tickets for Saturday, A Send reduced Hotel rate information                                       |  |
| Make all checks payable to "PERSONAL COMPUTINO<br>PC'77, Route 1, Box 242, Mays Landing, N.J. 08330                   | G '77'' and mail to:   |
| Name  | Amount enclosed  |
| Address   |  |
| City  | G  |
|   |  |







Since Bill Sevedge is taking a sabbatical for the next few months, I will be filling in to provide additional input which hopefully will be of value to those many club members who follow this column. Let's hit the subject which is near and dear to all clubs, of which none can escape the problems encountered.

via newsletters. In talking with many club editors, several areas have been pointed out that are common, and unfortunately are the toughest to resolve. Coming up with editorial content rates as top priority. The cause stems from well-meaning club members who volunteer their efforts at writing articles about their

experiences, applications, and tech-

niques that they have found useful.

The problem is communication

In some cases a few have lead the club editor on to expect great things, and all too often too many of these well-meaning volunteers do not intend to follow through. Meanwhile the club news editor embarks feverishly upon his task and attempts to write much of text for his

next issue. Experience teaches that people who follow through represent 1 out of 20 promised articles. To those people the editor gives an undying vote of thanks, as many untotaled hours have to be spent in

completing each issue.

If I have hit home and offended, it will only be those "turkeys" who know that they are guilty. The word is don't volunteer an article unless

you are willing and fully committed to come through. Your club newsletter editor needs as much time to develop the newsletter rather than chase never-to-be-written articles. Support your editor for he is the key to the communication lock and the future success of the club.

Now a word to the editors:

Since only a small fraction of what is promised does come through, I can offer a few tips which hopefully will lessen your burden. Send a letter to each semiconductor manufacturer requesting the names of the field service engineers and their in-house support applications for your area. Contact each one individually and ask him to provide some of the application hints about their products which would prove useful to your readership. In certain areas of the country different products prevail based on the amount of software that has been made available.

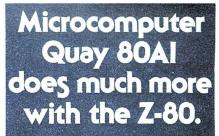
Secondly, contact some of the consulting firms in your area and manufacturing firms of end-products. Find out who the project engineers are, the types of applications that processors have used, and the problems overcome by their engineering team. You will find for the most part that those who are the decision makers in these companies are more willing to devote a little time to club effort than those who actually have to do the problem solving.

Your local computer stores are now getting to the point where their existence and success rely upon their ability to support their clients. From this source there is a wealth of knowledge to be tapped on how to avoid start-up problems. Most likely the store owners or their technicians will be more than happy to offer an educational article or two in hopes that it will prevent continual recurrence of these problems as the market expands.

If anyone else has additional tips or comments for the Sense Line, please send them in care of Sense Line, INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701.



Little Miss FIFO sat on her micro Sorting her ROMs and RAMs. Along camd the ICs that created the crises of FIFO to LIFO to GIGO.





This dynamite new microcomputer system in a kit moves data like nothing else on the market. Run it alone or plug it into an \$100 bus Altair/IMSAI. For solo performance, all you need is an unregulated power supply and an I/O device. Plugged in, Quay 80AI is a CPU, ROM, SIO, and RAM board—run any \$100 compatible device. BUT MORE THAN THAT. Quay 80AI's Z-80 CPU opens challenging new areas of personal computing.

#### **Features**

- S100 bus compatible. Plugs in one slot of your Altair or IMSAI.
- □ Z-80 w/2.5 MHz clock.
- ☐ 1 K static RAM.
- 512 byte (ROM) monitor. Comes up running, Inspect, alter, dump, and load memory; set breakpoint; jump to user program. Handles setial I/O or keyboard input, including setting baud rate.
- ☐ 4 UVEPROM (2708) sockets.
- ☐ Serial I/O. RS-232 and 20 ma interface.
- ☐ Parallel keyboard input. Accepts standard ASCII keyboard.
- ☐ UVEPROM programmer. Program 2708 type UVEPROMs.
- 2 phase clock and sync. Run \$100 compatible peripherals.
- 158 instructions. All 78 3080 instructions plus 80 new powerful instructions.
- On board voltage regulators.

Quay 80Al in a kit is \$450; factory assembled, \$600. Send for complete details. Or for fast action call 201-681-8700.

Mastercharge and BankAmericard accepted, COD with 1/3 deposit, N.J. residents add 5% sales tax. Price does not include shipping and handling.

Dealer inquiries invited.



P.O. Box 386, Freehold, N.J. 07728 Phone: 201-681-8700

'See us at Booths 341 & 342 in Atlantic City''



# If you like the Dumb Terminal, join the club.

The Dumb Terminal Fan Club, that is. Because in just two short years, the Lear Siegler Dumb Terminal has made thousands of friends. Throughout the world.

And there's a good chance you're one.

You might be a distributor, an OEM—even an end user. Or maybe just an admirer of good, practical design.

You might work with terminals for a living. Or assemble them for a hobby.

But it really doesn't matter. Because the Dumb Terminal Fan Club is strictly for fun. For everyone.

#### Be the first on your block.

Here's your chance to become a Dumb Terminal *charter* member.

And it's *so* easy. No goldfish to gulp down. No blood oath to take.

All we need is your completed membership application form and a measly \$6.00. (Cash, check, or money order, please.)

In return, you'll receive a nifty Dumb Terminal Fan Club Kit containing:

One official Dumb Terminal T-shirt. A good, practical design. (Just like the Dumb Terminal.) Fashioned in durable blue cotton/polyester. With a likeness of our Club Leader on the chest.

One 8" x 10" color photo of The Dumb

Terminal, Himself. Autographed and suitable for framing.

One official Dumb Terminal Fan Club Membership Certificate. To proudly display on your office, den, or garage wall. A real conversation starter

One official Dumb Terminal Fan Club Membership Card. Entitling you to all the rights, privileges, and fun of a *charter* member. Positive identification, should someone ask, that you're definitely one of us.

#### One Dumb thing after another.

In weeks to come, there'll be more Dumb fun.

Like an official Dumb Terminal Fan Club newsletter to help keep members informed of product updates and Club activities.

Plus posters, paraphernalia, and surprises, too.

So don't wait until you need another clean T-shirt—join the Dumb Terminal Fan Club today.

Chances are, it won't be the only thing you share with some of the smartest folks around.



| Name                                |       | Title | (?) |         |   |
|-------------------------------------|-------|-------|-----|---------|---|
| Company                             |       |       |     |         | 1 |
| Street                              |       |       |     |         | 1 |
| City                                | State | Zip   | - ( | THE     | 1 |
| Enclosed is \$<br>Quantity and size |       |       |     | TERMINA |   |

### **Editorial**

# THE SHADOW OF WHAT?

by Linda Folkard-Stengel, Associate Editor

Plato described humanity's perception of Truth as the observations of a tribe of troglodytes who never ventured beyond the rim of a deep cave opening. From that lower vantage point, shadows could be perceived on illuminated surfaces below. The shape of the figures and the patterns of movements indicated the possibility of beings not dissimilar to themselves. The troglodytes speculated on the nature of this world without, and that was the beginning of philosophy.

Long before Plato, human intelligence had perceived patterns, periodicity and non-recurring phenomena in the vault above. Like the philosopher's mythical cavedwellers, the luminous activity could yield only imprecise explanations as to its nature. Nevertheless speculation persisted and a vast body of fact, folklore

and fantastica accumulated with the Ages.

It is less than five centuries that scientists began to sort out the True from the Untrue and that largely happened when technology came to the aid of eye. The lens that sharpened human vision also focussed the human mind to the task of exploring the vault above, of cataloging the celestial bodies and even of proposing the daring concept that this dimension could be physically probed.

Beside vision the first tool of investigation into the nature of space was mathematics and this tool continues to serve with unblunted usefulness. We can only be impressed with the accuracy of ancient astronomical calculations. Many of them are still employed today along with the terms coined by these thinkers, terms such as ephemerides, sidereal time, aphelion, and periapsis.

However, before the Arabs, calculations were tedious and cumbersome. With the introduction of algebra, the "software" of astronomy could be written in terms manageable by more people. Later spherical geometry

would open the path to physical exploration.

In this century we have seen great advances in the realization of these ancient dreams. New planets have been sighted, unseen stars were detected and black holes discovered. The advent of the computer lightened the task of calculation.

From ancient times onward, astronomy had traditionally been the involvement of a very select few. Even today the global number of men and women who derive their livelihood from star-gazing would not populate a medium-sized village. Amateur astronomers, on the other hand, are numerous, probably numbering in the millions. Every fair-sized city boasts a planetarium and

many small telescopes are sold each year for recreational use. Books on astronomy move through bookstalls at a reasonable rate and many newspapers and periodicals carry celestial maps. A wide variety of sighting tables are sold to the public to assist in finding the celestial body of choice, whether natural or artificial.

In the recent decade three technological tools have come within the price range of the average budget. They are the camera, the telescope and the microcomputer. The combination of these three artifices has created a

new leisure endeavor, amateur astronomy.

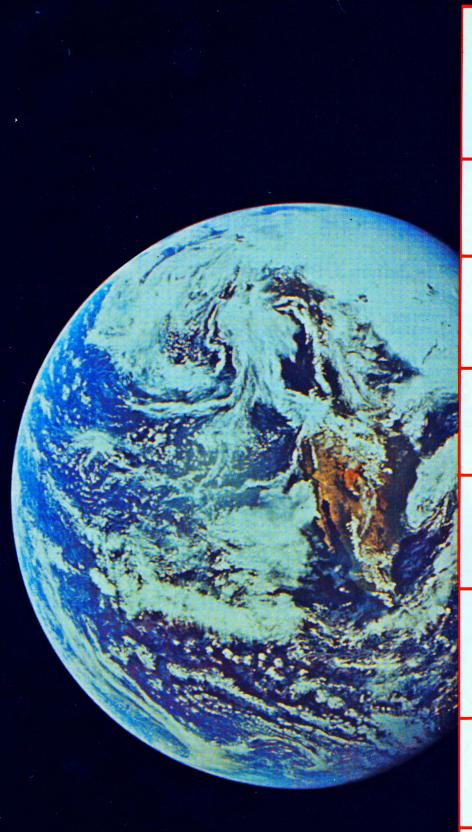
In a modern society few people are frightened by eclipses and the predicted event is usually well reported. Still despite the knowledge of the origin of the phenomenon, its rarity fascinates and awes. Many people travel far to witness the spectacle. In the past to calculate the date and path of an eclipse was a source of power; today it is a personal triumph of intelligence.

The space program through the medium of television keeps our attention focussed onto the firmament. As satellite cities take form in orbit around our world, the earthside dwellers will develop many new entertainment means through interaction with the orbiting bodies. Electronic games and communication means will develop between the earthbound and orbiting populations much the same manner as radio encouraged the Ham movement. Optimum communication windows will be plotted on home computers and systems of relays and information storage will be published for popular use. The Viking UPLINK/DOWNLINK program may well be a forerunner of this activity.

For the indwellers of the orbiting cities, the spacescapes available to them through their windows will surely serve to motivate interest in astronomy as a leisure activity. The absence of atmospheric film provides an additional viewing dimension even for hobby equipment while the private computers will relieve the

tedium of repetitious calculations.

In this issue we anticipate this future involvement. By publishing the work of both professionals and amateurs already involved, we are affirming our support of the future condition when the physical and intellectual descendents of Nickey Naumovich will climb beyond the rim of Plato's cave to discover for themselves the true nature of the universal phenomena now only indistinctly perceived and discerned. At that point Philosophy will abdicate and Science will reign.



# Features in This Section

Local Mean Time by James J. Brennan

Local Sidereal
Time and Date
by James J. Brennan

Solar Clock by John O. Bumgarner

Solar Eclipse Prediction by Microcomputer by Nickey Naumovich, Jr.

Computing the Positions and Orbits of the Planets by Tim O'Shaughnessy

Viking UPLINK/
DOWNLINK
by Sven Grenander

Star-Ship Simulation — Part I by Roger C. Garrett





# LOCAL MEAN TIME (LMT)

by James J. Brennan

#### DESCRIPTION

The following BASIC application program calculates the difference between GMT (Greenwich Mean Time) and LMT (Local Mean Time).

Mean time is the time as measured by the hour angle of the mean sun. When referred to the meridian at Greenwich, it is called Greenwich mean time, sometimes called Universal Time. Local mean time is the instant at which the sun crosses the meridian at the location of observation. This program adjusts and computes the variance between Greenwich and local mean time.

#### **PROGRAM**

OK
LIST

O REM LOCAL MEAN TIME

1 REM BY JAMES J. BRENNAN

10 REM PROGRAM TO GIVE LMT FOR ANY LONGITUDE

20 REM IN RELATION TO GMT (UT)

30 REM GIVEN THE LONGITUDE

40 PRINT"WHAT IS YOUR LONGITUDE IN DEGREES";

50 INPUT D

60 PRINT"MINUTES";

70 INPUT E

80 PRINT"SECONDS";

90 INPUT F

100 J=D\*60

110 K=J+E

120 L=K\*60

130 Q=L+F

140 REM Q IS THE TOTAL SEC OF LONGITUDE

150 A=.0666667

160 S=Q\*A

170 B=60\*A

180 C=B\*60

190 IF S=>60 THEN S=S-60:M=M+1:GOTO 190

200 IF M=>60 THEN M=M=60:H=H+1:GOTO 200

210 PRINT"HERE IS A DIFFERENCE OF

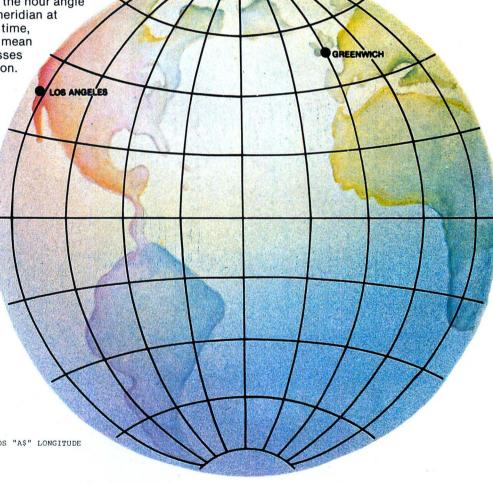
230 PRINT"HERE IS A DIFFERENCE OF

231 PRINT"BETWEEN GMT AND THE LMT AT

250 PRINT D" DEGREES,"E" MINUTES, AND"F" SECONDS "AS" LONGITUDE

RUN WHAT IS YOUR LONGITUDE IN DEGREES? 121 MINUTES? 07 SECONDS? 30

THERE IS A DIFFERENCE OF 8 HOURS, 4 MINUTES, 30 SECONDS BETWEEN GMT AND THE LMT AT 121 DEGREES, 7 MINUTES, AND 30 SECONDS LONG! OK



At noon Greenwich mean time, the local mean time for Los Angeles is 3 hours, 55 minutes, 30 seconds A.M.

# Introducing HEATHKIT COMPUTERS

A new value standard in personal computing systems featuring two powerful computers with better software, full documentation and service support from the Heath Company.

Heath Company has been interested and involved with personal computing since we first marketed an analog computer system all the way back in 1957. This continuing interest, along with the recent technological advances that have brought personal computing to the forefront of the electronics marketplace, has given us the opportunity to think through the recent developments, and develop two "total design" computer systems that give the computer hobbyist, whether beginner or advanced, everything needed for REAL power, performance and reliability — at prices that give you MORE value and performance for your computer dollar!

Total system design. The Heathkit computer line, both hardware and software, has been designed from the ground up to be a total computing system that meets all the needs of the computer hobbyist. The two mainframes are based on performance-proven well-documented MP modules, the 8080A and LSI-11. Using these CPU's was a conscious design decision, because of their proven performance, reliability and efficiency, and the tremendous amount of existing applications programs, documentation and source materials that are available. The Heath-designed CRT terminal, paper tape reader/punch, serial and parallel interfaces make total system setup easy and fast, and the Heath-designed software provided assures immediate usefulness and versatility.

Superior documentation. Heath Company is world-famous for the accuracy and clarity of its instruction manuals. The Heath computer line continues this well-deserved reputation. Assembly and operations manuals are written with easy-to-understand step-by-step instructions that leave nothing to chance. Simply follow the easy-to-understand instructions in the manual and you'll be up and running fast. As in all Heathkit products, easy self-service and troubleshooting is a definite benefit that can result in substantial cost-savings over the life of a product. These considerations, along with nationwide service and technical assistance at Heathkit Electronic Centers or the Heathkit factory, mean that you

have the most reliable protection for your computer investment available anywhere.

System versatility. Both Heathkit computers offer full expansion potential to provide outstanding flexibility and adaptability to meet any application. Mass storage capability is available in both audio cassette and paper tape format on the H8 and in paper tape format on the H11 for added convenience. Additional memory expansion boards can be added to either unit, along with an expanding number of I/O devices.

Continuing Development. Heath will continue to design and develop new compatible products for their computer systems. Coming in the future will be — floppy disk storage, line printer, additional applications programs, and self-instructional courses in programming and assembly languages. All Heathkit computer users are eligible to join HUG (the Heath User's Group) and H11 customers are eligible to join DECUS, the Digital Equipment Computer User's Society.

We're confident you'll find the Heathkit computer line one of the most intelligent, sensibly developed and complete product lines available today. It offers you total versatility and expansion capability to go wherever your imagination and computing prowess take you. And, in the Heathkit tradition, it offers the best price/performance and reliability combination you'll find anywhere.







A unique, value-packed computer featuring an "intelligent" front panel with built-in extended ROM monitor, octal entry keypad and digital readout, exclusive Heath bus, a pre-wired and tested 8080A-based CPU, and complete systems software at no extra cost!

\$375°°



### **HEATHKIT 8-BIT DIGITAL COMPUTER**

A low-cost digital computer that's easier to build and to use! Features an intelligent front panel with keyboard entry and 9-digit display, a heavy-duty power supply with enough extra capacity for memory and I/O expansion and

a 50-line fully buffered bus capable of addressing 65K bytes and a mother board with positions for up to 10 plugin circuit boards. Includes BASIC, assembler, editor and debug software at no extra cost!

The Heathkit H8 computer is an 8-bit machine based on the popular 8080A chip. It is one of the lowest-cost general-purpose computers on the market, and thanks to Heath's exclusive design, one of the most versatile.

The interrupt controlled "intelligent" front panel gives you far more power and control than is found on conventional units with bit switches and indicators. The 16-digit keyboard allows octal data entry and control that's far faster and less error prone than binary switches. The 9-digit octal readout provides you with more information than conventional models too.

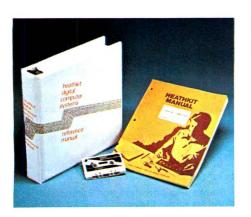
The octal keyboard and display emulate a true hardware front panel with complete access to memory, all registers and functions. The 9-digit seven-segment octal display has three readout modes: 6 digits of address and 3 digits data; 6 digits register data and 2 digits register identification; and three digits data with three digits port address. The front panel functions are defined by a panel monitor control program (PAM-8) stored in a 1K x 8 ROM on the CPU board. The complete access to 8080 internal circuits and functions makes the H8 an ideal trainer and learning tool.

Complete front panel functions include: display and alter of memory locations; display and alter of registers; dynamic monitoring of registers or memory during program execution; program execution control including break-point capability and single instruction step; automatic tape load and store through a built-in routine that allows programs to be loaded with a single button; and write or read any I/O port. The front panel of the H8 is so versatile it's like having a mini I/O terminal built right in!

Other features of the H8 front panel include status lights for power-on, run, monitor and interrupt enable; a built-in speaker for audible feedback on keyboard entry. The speaker also can be programmed for variable tones, permitting a variety of special effects to be generated.

The CPU board is fully wired and tested. It features the 8080A, clock, systems controller, ROM monitor and full bus buffering. Seven vectored interrupts are available on the bus for quick response to your I/O requests. A built-in clock lets you design and run in real time.

The H8 uses an exclusive, Heath-designed bus which incorporates many practical improvements over existing busses. The bus is fully buffered to reduce noise and crosstalk and is "glitch" free to eliminate timing problems. Three-state line drivers and receivers are used on all bus lines to eliminate loading problems. The 50 lines include address, data, control, clock and interrupt lines, plus all signals needed to support the 8080 MPU and virtually any I/O or memory accessory. The bus is implemented on a heavy-duty printed circuit mother board with wide, heavy copper foils for greater physical strength plus reduced crosstalk and noise. The board has 10 positions for installing



Comprehensive Heathkit assembly and operations manuals give you the superior documentation you NEED for a thorough understanding of your H8.

Systems software is supplied in audio cassette format.

connectors that accept the front panel, CPU, memory, I/O and accessory cards. All I/O bus connectors are included with the mother board for fast and easy expansion when you want it.

The H8's built-in power supply is convection cooled for adequate ventilation without the use of noisy fans. Separate IC regulators provide distributed regulation with a heat sink on each circuit board for excellent heat dissipation. Power supplies of +8, -18 and +18 volts are provided to handle up to 32k memory plus three I/O interfaces. Switch-selectable 120 V, 60 Hz or 240 V, 50 Hz AC increases versatility.

The H8 includes all system software in 1200 baud audio cassette form at no extra charge. The Benton Harbor BASIC™ is an enhanced version of standard Dartmouth BASIC with unique statements and commands to extend usefulness. The efficient compression techniques of the Benton Harbor BASIC permit you to put more program in less space.



All H8 systems software is supplied in audio cassette form. Also available in paper tape (H8-15, page 5) at extra cost.

HASL-8 The Heathkit Assembly language is a 2-pass absolute assembler that lets you program with easily understood mnemonics and generates efficient machine language code. A minimum of 8K memory is required.

The TED-8 software is a line-oriented text editor used for generating source programs for the assembler or general word processing. Requires a minimum of 8K memory.

The BUG-8 a powerful terminal console debug program, is an enhanced and extended version of the front panel monitor program to allow entry and debugging of user machine language programs via an external terminal. Requires 3K memory plus user program.

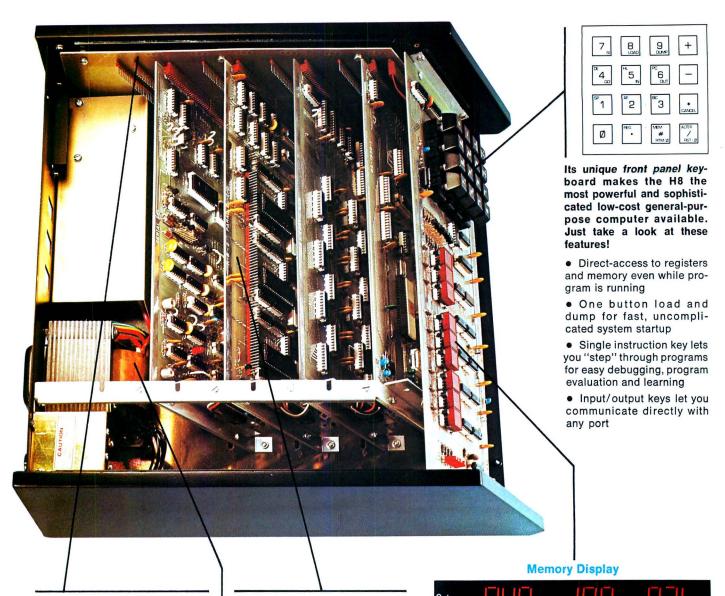
The H8 is housed in a rugged, heavy-duty cabinet, 161/4 W x 61/2 H x 17 D. Requires at least one H8-1 Memory.

Suggested applications for the H8 computer: As a trainer—learn microprocessor operation, interfacing and programming. The powerful front panel lets you get at and use all parts of the unit. As an entertainment center—use game and other applications programs for entertainment the whole family can enjoy.

As a hobby computer—the H8 can be used to process any information you program into it—it's perfect for hobby experimentation and design. A variety of peripherals and interfaces let you use it with other equipment—run your Ham radio station, control your model railroad systems, etc.

As an educational system—the H8 is ideal for schools, community colleges, libraries, etc. Full H8 software permits teaching BASIC plus machine and assembly language programming.

As a home management center—use the H8 to keep telephone numbers, monitor your budget, keep your checkbook balanced, do your income taxes, inventory your personal belongings. There are hundreds of ways the H8 can make your life more convenient.



The unique Heath-designed 50-pin bus is implemented on a heavy-duty printed circuit board with heavy copper-foil bus lines. The 10-position mother board is complete with all connectors. The bus lines are fully buffered to eliminate noise and crosstalk, and "glitchfree" to prevent timing problems.

Modular circuit boards slide into the H8 mainframe for easy memory and I/O expansion, easy access for servicing. The boards are in a semi-vertical position with unconfined heat sinks to enhance convection cooling and improve heat dissipation.

Heavy-duty power supply, rugged steel chassis and securely mounted and braced circuit boards make the H8 a truly reliable and longlife machine.

# High Order Address Location Address Location Uccation 040 100 Register Display High Order Contents Contents I/O Port Display

Port Number

### Data

### Unique Heathkit Software.

The Heathkit software supplied with the H8 computer has a number of features that make it easier to use and more practical than conventional systems. Automatic "command completion" simplifies typing; dynamic syntax checking instantly alerts you to errors and a special user configuration lets you really personalize your system. H8 software pushes the state-of-the-art a generation ahead — it's memory efficient to give you more computing power for your memory dollar, modular design for easy expansion, and thoroughly documented for easy programming and maximum effectiveness.

### H8 "Intelligent" Front Panel

The H8 front panel digital readout is the most informative display available on any personal computer to date. All displays are continuously updated even while your program is executing, giving you instant access to registers and memory for direct monitoring of program activity.

MEMORY DISPLAY — Shows memory location and contents using 6 digits for address and 3 digits for data.

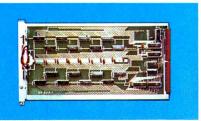
**REGISTER DISPLAY** — Shows CPU-register contents using 6 digits for data and 2 digits for register identification.

I/O PORT DISPLAY — Shows I/O port data and location using 3 digits for data and 3 digits for port address.

### **H8 ACCESSORIES, SOFTWARE AND MANUAL SET**



The H8 CPU is fully wired and tested to insure quick and trouble-free system startup. It contains the performance proven 8080A microprocessor chip, a 1Kx8 ROM with monitor program for controlling the front panel and input-output (load-dump) routines. Other features of the CPU include: 7 vectored interrupts, DMA capability, crystal-controlled clock and fully buffered bus with three state drivers. Use of the 8080A, which has the largest software library of any microprocessor, along with Heath software and documentation, makes the H8 one of the most practical and immediately useful computers you can own.

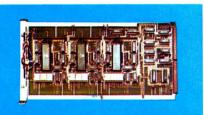


H8-1 Memory Board. 8Kx8 memory card supplied with 4K memory, plugs directly into H8 bus. Features maximum storage capacity of 8192 8-bit words. Uses modern 4Kx1 static memory IC chips for easy assembly and service. Access time, less than 450 nS. With on-board regulators, heat sinks and full buffering. Expandable to 8K memory with H8-3 chip set below.

Kit H8-1, Shpg. wt. 2 lbs. ......140.00 H8-3 Chip Set. Kit of eight 4K static mem-

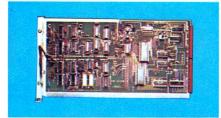
ory IC's. Expands H8-1 to full 8K storage. With sockets.

Kit H8-3, Shpg. wt. 1 lb. . . . . . . . . 95.00



H8-2 Parallel Interface. Connects H8 to any parallel device such as a paper tape reader/punch (required for H10) or line printer. Has three independent parallel ports, each with 8 bits input and 8 bits output and universal handshaking capability. Compatible with all Heath software. 390 µS maximum transfer time. With diode-clamped inputs, buffered outputs and full interrupt capability.

Kit H8-2, Shpg. wt. 3 lbs. . . . . . . . 150.00



### H8-5 Serial I/O and Cassette Interface.

Connects the H8 to serial devices such as the H9 video terminal (page 10) or the H36 DEC Writer II (page 12). Features jumper selectable data rate from 110 to 9600 baud, plus common input/output interfaces including 20 mA current loop and EIA RS-232C compatible levels. The cassette recorder interface permits the use of standard cassette recorders (Heathkit ECP-3801, page 12). Uses the popular Byte/Manchester or "Kansas City" standard recording format with a 300 or 1200 baud read/record rate. Control lines for remote start and stop of two cassette units allow separate record and playback for easy program or file editing. Also has full interrupt capability. LED test circuit for easy board setup and overall system servicing. Fully compatible with all Heath software.

Kit H8-5, Shpg. wt. 3 lbs. . . . . . . . 110.00

NOTE: Proper operation of the H8-5 is assured only if you use the Heath ECP-3801 cassette player/recorder and Heath-recommended recording tape (ECP-3802, page 12). Heath is not responsible for improper operation associated with other cassette units.

### **Extended Benton Harbor BASIC**

Extended Benton Harbor BASIC is an enhanced and more powerful version of the BASIC supplied with the H8. It provides even faster operation and includes character strings, additional convenience commands and math functions, dynamic storage allocation, access to real time clock, keyboard interrupt processing, expanded error messages and recovery ability, LED display control and key pad support. A minimum of 12K memory is required to run this BASIC, 16K is preferred if full use is to be made of its capabilities.

### **Paper Tape Systems Software**

A paper tape version of the systems software supplied with the H8 computer. It consists of four fan fold paper tapes, one each for Benton Harbor BASIC, HASL-8 assembler, TED-8 editor, and BUG-8 debug. For use with the H10 paper tape reader/punch or other paper tape I/O equipment.

H8-15, Shpg. wt. 1 lb. . . . . . . . . . . 20.00

### **H8 Manual Set**

Find out about the H8 before you buy! This manual set includes the complete assembly and operations manuals for the H8 Digital Computer, H8-1 memory card, H8-2 parallel interface, H8-3 4K memory expansion chip set, H8-5 serial and I/O cassette interface, H9 video terminal and H10 paper tape reader/punch. H8 software documentation covering monitor, editor, assembler, debug and BASIC is also included. In handsome 3-ring binder.

HM-800 Manual Set.

Shpg. wt. 11 lbs. . . . . . . . . . . . . . . . . . 25.00

The purchase price of the HM-800 manual set will be refunded when you buy the H8. Simply include HM-800 saleslip with your order.





You can get even more excitement and practical use from your H8 by joining HUG, the Heathkit User's Group. It will put you in contact with other Heathkit computer users, provide a program library and an informative newsletter to keep you up to date. A HUG application is enclosed with each Heathkit computer product. See page 12 for further details.

## 

Two of the finest names in modern electronics, Heath and Digital Equipment Corporation (DEC) combine to bring you the world's first 16-bit computer priced within reach of the general public!

\$129500





The H11 and all its accessories will be available November 10th, 1977.

## HEATHKIT'DIGITAL EQUIPMENT CORPORATION® HII DIGITAL COMPUTER

Heath and DEC join forces to bring you mini-computer performance at a microcomputer price! The H11 features a fully wired and tested DEC KD11F board that contains the 16-bit LSI-11 CPU, 4096 x 16 read/write MOS semi-

conductor memory, DMA operation; and includes the powerful PDP-11/40 instruction set, PLUS Heath/DEC PDP-11 software. Equivalent commercial versions of the H11 would cost \$1,000's of dollars more!

The new Heath/DEC H11 personal computer is one of the most powerful and sophisticated units available today! It combines the advanced, performance-proven hardware and software of the LSI-11 with Heath's expertise in kit design and documentation to bring you a personal computer of almost incredible power and flexibility. Equivalent commercial versions of the H11 would cost over twice as much, and you still wouldn't get the superior documentation and support of the H11!

The LSI-11 bus is a mechanically and electrically superior bus with 38 high-speed lines containing data, address, control and synchronization lines. Sixteen lines are used for time multiplexing of data and addresses. All data and control lines are bidirectional, asynchronous, open-collector lines capable of providing a maximum parallel data transfer rate of 833K words per second under direct memory access operation.

The 16-bit CPU functions are contained on four MOS LSI integrated circuit chips. These chips provide all instructions, decoding, bus control, and ALU functions of the processor. The CPU has eight general registers which serve as accumulators, index, autoincrement/autodecrement registers or stack pointer.

The KD11F memory is a 4096-by-16 MOS semiconductor memory composed of LSI 4K dynamic RAM chips. These chips require little power, provide fast access time, and are refreshed automatically by the processor's microcode. Additional memory cards can be added to expand memory capacity up to 20K in the H11 cabinet (32K words total).

The backplane/card guide assembly holds the microcomputer and up to six I/O and memory modules. All LSI-11 bus data, control, and power connections are routed on the printed circuit backplane to each module location. The backplane/card guides are fully compatible with all standard DEC LSI-11 accessories.

An efficient, well-designed switching power supply provides the required DC voltage for the LSI-11 as well as all accessory modules. The supply features overvoltage and overcurrent/short-circuit protection, power fail/automatic restart and a built-in fan for quiet cooling. The dual primary power configuration can be connected for 115 V, 60 Hz or 230 V, 50 Hz input power.

Has single-level, vectored, automatic priority interrupt, real-time clock input signal line, ODT/ASCII console routine/bootstrap resident in microcode for automatic entry into debugging mode, replacement of panel lights and switches with any terminal device generating standard ASCII code, and the ability to automatically commence operation through resident bootstrap routines.

The H11 is supplied with versatile PDP-11 software including editor, relocatable assembler, linker, absolute loader, debug program, I/O executive program, dump routines, BASIC and FOCAL (See details below). The software requires a minimum of 8K memory, with 12K to 16K total memory recommended for maximum capability. Rugged metal cabinet measures 6½ H x 19″ W x 17″ D. For 110/220 VAC, 50/60 Hz.

### POWERFUL HEATH/DEC PDP-11 SOFTWARE AT NO EXTRA COST!

The H11 includes a sophisticated software system that lets you get your computer up and running with practical programming capabilities. This paper tape based software would cost over \$1200 if purchased separately. A minimum of 8K memory is required to run the software. The programs include:

ED-11. Assists you in the creation and modification of ASCII source tapes, also used to write assembly language programs and for general text editing or word processing functions.

PAL-11S. Relocatable assembler converts ASCII source tapes into relocatable binary modules. This lets you create programs in small, modular segments for easier coding and debugging. These binary modules serve as inputs to LINK-11S.

LINK-11S. Link editor which links the modules created by the PAL-11S into a load module ready for execution on the H-11. The module is loaded into the H-11 via the Absolute Loader.



The H11 is complete with superior Heathkit documentation and versatile system software.

Absolute Loader. Loads absolute binary tapes into the H11 memory for execution.

ODT-11X. Lets you debug the programs which you have created. Permits modifying and controlling program execution "on the fly" for quick, efficient debugging.

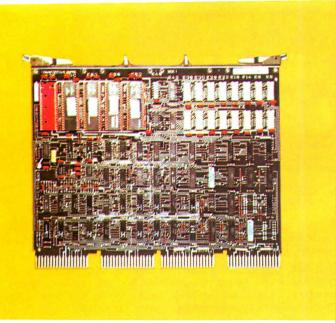
IOX. I/O executive program permits I/O programming without developing device-driving programs. Links to your programs using the LINK-11S. For use with high speed paper tape reader/punch and line printer.

**DUMP-AB** and **DUMP-R**. Lets you dump absolute binary contents of memory into the paper tape punch.

BASIC. DEC's powerful version of standard Dartmouth BASIC interpreter uses english-type statements and mathematical symbols to perform operations. Immediately translates, stores and executes the program. Includes string capability.

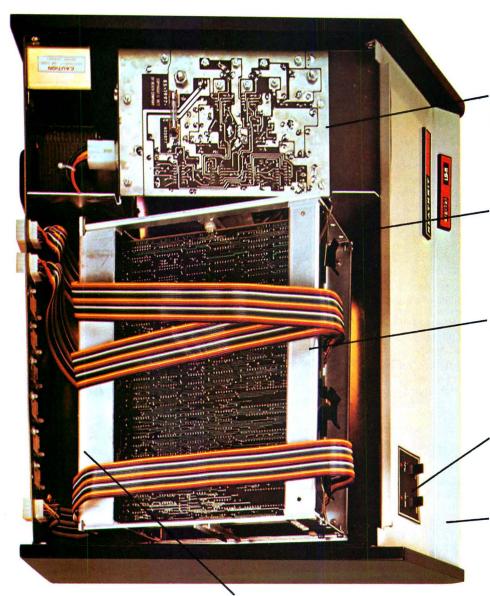
FOCAL™. DEC's own interpretive computer language which combines simplicity with computing power. Ideal for most scientific, engineering and math applications. FOCAL™ programs can be written and executed easily. Both 4K and 8K versions are included.

NOTE: H11 owners are eligible for membership in the Digital Equipment Computer User's Society (DECUS). This organization provides useful symposia, newsletters, program library and other useful information to help you get the most from your LSI-11 computer.



### **FULLY WIRED AND TESTED KD 11F BOARD**

The "heart" of the H11 computer is the standard DEC LSI-11 microcomputer board. The 16-bit CPU functions are contained in four silicon gate N-channel MOS LSI integrated circuit chips for high reliability and superior performance. The 4096-by-16 read/write MOS semiconductor memory is composed of LSI 4K dynamic RAM chips that provide fast access time and require little operating power. The CPU executes the powerful PDP-11/40 instruction set with over 400 instructions. There are no separate memory I/O or accumulator instructions, so you can manipulate data in peripheral device registers as easily and flexibly as in memory registers. The LSI-11 board is supplied fully wired and tested to facilitate kit assembly and provide greater reliability and less chance of error.



Compact, efficient switching power supply uses less power to operate and generates less heat than conventional supplies. Overvoltage and overcurrent/short circuit protection, along with automatic power-up and power-down sequencing, provide high reliability and long life operation.

Built-in quiet-running fan provides efficient cooling and prevents heat buildup.

Card cage with backplane accommodates up to six accessory cards in addition to LSI-11. The card cage swings up for easy access and service even while the H11 is operating. Accessory boards slide directly into card guides with all connectors supplied.

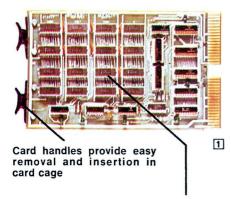
Front panel controls include DC power switch and run/halt switch. Status lights indicate processor activity.

Styled and sized to match Heathkit peripherals for total system continuity.

Rugged steel chassis and extra-thick backplane with heavy, solid connectors for added strength and years of superior performance.

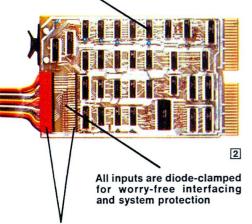
The H11 and all its accessories will be available November 10th, 1977.

### HII ACCESSORIES, SOFTWARE AND MANUAL SET



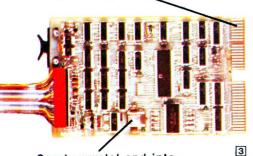
Sixteen state-of-the-art 4K static memory chips for high density storage

All IC's are socketed for easy kit assembly, easy access for service or trouble-shooting



Separate cables and rear panel connectors for highbyte and low-byte increase system flexibility

Gold-plated edge connectors maintain superior electrical contact for high reliability and long life \_\_\_\_



Quartz crystal and integrated baud rate generator has superior accuracy for reliable system interfacing

### 

Plugs into H11 backplane, adds 4K x 16-bit word capacity to H11 memory. Uses high-reliability 1Kx4 static MOS RAM chips. Access time is less than 500 nS. Has decode circuitry for operation on 4K address boundaries. Handle for easy removal and insertion. Compatible with PDP 11/03 and other LSI-11 backplane machines.

Kit H11-1, Shpg. wt. 2 lbs. . . . . . . 275.00

### 2 H11-2 Parallel Interface

General-purpose parallel interface featuring 16 diode-clamped latched data input lines, 16 latched output lines, 16-bit word or 8-bit byte data transfers. Has LSI-11 bus interface and control logic for interrupt processing and vectored addressing; control status registers compatible with PDP-11 software routines. Four control lines for output data ready, output data accepted, input data ready and input data accepted logic operations. Maximum data transfer rate, 90K words per second under program control. Maximum drive capability, 25-ft. cable. Plugs into H11 backplane, can be used with DEC PDP-11/03 and other LSI-11 backplane machines. Also compatible with TTL or DTL logic devices. The H11-2 is required for interfacing the H11 to the H10 Paper Tape Reader/ Punch.

Kit H11-2, Shpg. wt. 2 lbs. . . . . . 95.00

### 3 H11-5 Serial Interface

Universal asynchronous receiver/transmitter serial interface module for use between LSI-11 bus and serial devices such as the Heathkit H9 video terminal (page 10) or LA36 teleprinter (page 12). Has optically isolated 20 mA current loop and EIA interfaces; selectable baud rates of 50, 75, 110, 134.5, 150, 200, 300, 600, 1200, 1800, 2400, 4800 and 9600. Plugs into H11 backplane, fully compatible with PDP 11/03 and other LSI-11 backplane machines. With all mating connectors.

Kit H11-5, Shpg. wt. 2 lbs. . . . . . . 95.00

### H11-6 Extended Arithmetic Chip

Adds powerful arithmetic instructions to the LSI-11, including fixed point multiply, divide and extended shifts plus full floating point add, subtract, multiply and divide. Helps minimize or eliminate arithmetic sub-routines, speeds up program execution and eases program development. Saves memory space too. 40-pin dual-inline package IC plugs into socket on KD11F board.

H11-6, Shpg. wt. 1 lb. . . . . . . . . . . 159.00

### **Manual Set for H11 Computer**

Includes complete assembly and operation manuals for the H11 Digital Computer, H11-1 4K memory board, H11-2 parallel interface, H11-5 serial interface, H9 CRT terminal, and H10 paper tape reader/punch. Also includes complete soft-



ware documentation — monitor, editor, assembler, linker, BASIC, FOCAL and related software. In handsome 3-ring binder.

### HM-1100 Manual Set,

Shpg. wt. 12 lbs. . . . . . . . . . . . . . . . 25.00

NOTE: The price of the manual set can be deducted when you order an H11.

NOTE: DEC, DIGITAL, FOCAL and PDP are registered trademarks of Digital Equipment Corporation.

### **Special DEC Software License Requirement**

H11 purchasers are required to fill out and sign the DEC license agreement on page 15. Please do so and include with your H11 order. Heath cannot ship merchandise without this license agreement.



### **H9 LONG AND SHORT-FORM VIDEO DISPLAY TERMINAL**

The H9 video terminal is a general-purpose computer peripheral designed for use with the Heathkit H8 or H11 computers. It provides keyboard input and a CRT for the convenient entry and display of computer programs and data. The H9 can be used with any digital computer in dedicated stand-alone applications or in time-sharing systems.

Character format is standard upper case 5 x 7 dot matrix. The long form display is twelve 80-character lines. The short form display is forty-eight 20-character lines in four 12-line columns. The automatic line carryover feature executes line feed and return when line exceeds character count on both long and short form displays. A built-in oscillator/speaker generates a 4800 Hz tone and serves as audible end-of-line warning.

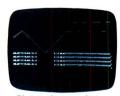
Auto-scrolling is featured in both long and short form. In the long form, as the line enters at bottom, the top line scrolls off-screen; in the short form, as new column enters from right, the left column scrolls off-screen. Auto-scrolling can be



Long form - twelve 80-character lines



Short form — forty-eight 20-character lines



Plot mode - graphs, curves, simple figures

Three separate modes give the H9 real display versatility

defeated with a front panel switch. The cursor mark indicates the next character to be typed for accurate positioning. Cursor control keys include up, down, left, right and home. Serial data baud rates are selectable from 110-9600. Baud rate clock output and reader control are available on the rear panel connector. The erase mode permits automatic full page erase or erase to end of line starting at cursor position. A transmit page function allows a full page to be formatted, edited and modified, then transmitted as a block of continuous data.

The plot mode permits graphs, curves and simple figures to be displayed. Plot-



Control PC board is fully assembled and tested for added reliability and simplified kit assembly. A wiring harness with connectors helps reduce time-consuming point-to-point wiring.

ting can be accomplished via the keyboard or from external inputs.

The H9 serial interface provides EIA RS-232C levels, a 20 mA current loop or standard TTL levels. Parallel interfacing includes standard TTL levels, 8 bits input and 8 bits output and 4 handshaking lines.

Ultra-compact size, only 12½" H x 155%" W x 20¾" D, makes the H9 ideal for desktop or console applications. For 110 VAC, 60 Hz or 230 VAC, 50 Hz.

Kit H9, Shpg. wt. 50 lbs. . . . . . . . 530.00

### Full ASCII 67-key Keyboard

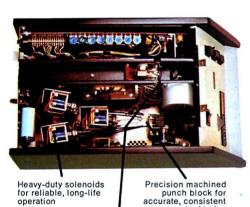
Function keys are positioned away from characters to prevent miskeying and error.

Standard typewriter keyboard for easy, more accurate input.

Wide, easy-to-use space bar aids accurate typing.



### HIO DELUXE PAPER TAPE READER/PUNCH



Advanced reader design with stepper motor and solid-state sensors for accurate reading

punched holes

The H10 is a complete paper tape reader/punch mass storage peripheral using reliable low-cost paper tape. It's fully compatible and styled to match with the H8 and H11 computers. It also works reliably with any other computer through a parallel interface. The H10 uses standard 1" wide roll or fan-fold 8-level paper tape. Standard punched paper tape gives you the reliability, durability and trouble-free handling you need for effective mass storage of programs and data.

The reader reads tape at a maximum rate of 50 characters per second. A full sensitivity adjustment on each channel permits any color, thickness, quality (oiled

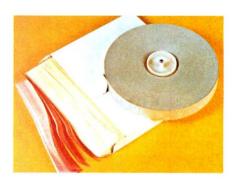
or unoiled) paper tape to be used. Sensitive photo Darlington transistors and an incandescent lamp reader head provide reliable reading. The powerful stepper motor drive insures accurate tape positioning and movement.

The punch operates at a maximum speed of 10 characters per second. Precise ratchet/solenoid drive and reliable solenoid control of punches provide high-accuracy punching. The precision dieblock punch head gives you positive and consistent punching.

Controls include power on-off, read and punch start. A feed control feeds blank paper tape through the punch to produce leader tape. A copy control on the rear panel permits tape being read to be duplicated by the punch for efficient and accurate tape copying.

Interface has parallel 8-bit input bus for punch, parallel 8-bit output bus for reader, standard TTL logic levels and handshaking lines for both reader and punch. A rear panel 24-pin interface connector and mating cable are supplied. The H10 is fully compatible with Heathkit H8 and H11 computers when the appropriate parallel interface accessories are used. It can also be interfaced with other computers with parallel interface facility.

Accessories include holder for roll paper tape, chad collector tray, and collector box for fan-fold tape. With 8" roll (900 ft.) blank paper tape.



Styled to match the Heathkit H8 and H11 computers. Cabinet with metal top and rugged steel chassis, 125%" H x 934" W x 195%" D. For 110-130 VAC, 60 Hz, or 220-240 VAC, 50 Hz.

Kit H10, Shpg. wt. 29 lbs. . . . . . . 350.00

H10-2, Three Blank Rolls Paper Tape, each 8" diameter, 900 ft. min.

H10-2, Shpg. wt. 5 lbs......10.00

**H 10-3**, Three Boxes Blank Fan-fold Tape. Approx. 1000 ft. each.

H10-3, Shpg. wt. 5 lbs......10.00





### ECP-3801 Cassette Recorder Storage Device

Has volume and tone controls, pushbuttons for record, play, rewind, fast forward, stop and eject, built-in 3-digit counter with reset button. Factory wired, not a kit.

Heath recommended high output, low noise, premium grade audio recording tape. Pack of three 30-minute blank cassettes.

ECP-3802, Shpg. wt. 1 lb. . . . . . . . . . . . . . per pack 5.00

\*NOTE: Proper operation of the H8-5 and H8 software is assured only when the ECP-3801 cassette recorder and ECP-3802 tape is used. Heath does not assume responsibility for improper operation resulting from the use of any other cassette units.

### **HUG**<sup>®</sup> the Heathkit User's Group

Our new user's group brings you in contact with other Heathkit computer owners and users, provides a newsletter, a program library, new product information and hardware/software ideas. Membership in HUG is a useful, practical way to get the maximum enjoyment and benefit from your Heathkit computer system. Here's what you get:

- 1 year subscription to the quarterly newsletter
- Software library allowing you to submit programs and obtain programs submitted by others. A modest fee will be charged for software duplication.
- An attractive 3-ring binder to hold newsletters, software documentation and other materials.
- Program submission forms
   Software library catalog
- HUG membership list
   Credit toward purchase of software

Dues are \$14.00 for one year. Complete details of HUG membership are included with every Heathkit computer product. H11 owners are also eligible for membership in DECUS, see page 7 for details.

### **LA36 DEC Writer II Keyboard Printer Terminal**

The famous LA36 DEC Writer II with true 30-cps throughput, variable-width forms handling, 128-character upper/lower case set, and extra-quiet operation. Fully assembled, factory tested and ready to use!

The LA36 is an advanced technology teleprinter offering fast, reliable operation at one of the best price/performance ratios in the industry. It features a 7x7 dot matrix print head for crisp, clear character formation; switch-selectable 10, 15 and 30 cps printing speeds; variable width forms handling from 3 to 147%" wide; adjustable right and left hand tractors for precise margin positioning; half or full duplex operation; ANSI-standard multikey rollover and a typewriter-like keyboard.

The precision-designed stepper motor paper feed has fine vertical adjustment for accurate forms placement. LA36 will handle up to 6-part forms with a .020" maximum pack thickness. Print format is 132-column, with 10 characters per inch horizontal spacing and 6 lines per inch vertical spacing. Uses the entire 128 character ASCII upper/lower case set with 95 printable characters. A CAPS-lock key simplifies data entry. A parity check on output prints a replacement character, strappable to odd, even, or none with mark or space. A last-character visibility feature moves the head four columns to the right when printing stops, returns to proper position when printing is resumed.

The integral 20 mA current loop interface makes the LA36 compatible with both the H8 and H11 computers, as well as all other hobby and personal computers. Operates on 90-132 VAC or 180-264 VAC for reliable performance even under brown-out conditions. With connecting cable and integral stand for easy setup. Overall size,  $27\frac{1}{2}$  W x  $33\frac{1}{4}$  H x 24 D.

H36 (LA36 DEC Writer II) Shipped Motor Freight, prepaid to your nearest terminal within the Continental U.S. Include your phone number on order for notification of arrival. Arrangements home delivery at extra charge at your option. NO C.O.D ORDERS ACCEPTED. \$1495.00

H36-1 Fan-fold paper for H36. Standard 14% "x 11" white and green, single part, lined paper. 3450 sheets per carton.

H36-2 EIA Interface. Provides EIA RS232-C or CCITT-V24 interface for LA36. Includes auto answer, timed disconnect and half/full duplex logic. Straps are available to send timed break (230 mS), 3000 mS long space, forced disconnect or do nothing (stops printing, discards data) on a paper-out condition. Modem controls and a 9-ft. cable with 25-pin data-set type connector are also supplied. Factory wired, not a kit.

### APPLICATIONS SOFTWARE—COMING SOON!

Both the H8 and H11 Digital Computers are supplied with complete systems software that provide you with everything you need to develop your own specific applications programs. However, you can make your computer immediately useful by using the programs below. These programs represent the beginning of a complete series of application software packages that will allow you to get immediate value from your computer system without a time consuming software development effort on your part. Described below are a series of game packages that make your computer an excellent source of entertainment and leisure time activities.

BLACKJACK. An interactive program game that allows four players to play the card game blackjack on the computer. The computer performs all of the functions of the dealer and keeps track of player progress, winnings and losses. The program is written in and runs under extended BASIC and requires a minimum of 16K of RAM in the H8 and 8K in the H11. Standard Las Vegas casino blackjack rules apply.

BIORHYTHM. This popular applications program computes standard biorhythm information and plots sinusoidal curves of your physical, emotional, and intellectual characteristics over a given time period. The biorhythm program will show you your ups and downs and will tell you your good and bad days. It will help you plan your activities. While this program is not a game, it is an entertaining activity that you and your friends and family will enjoy. The program runs under extended BASIC and requires 16K of RAM in the H8 and 12K RAM in the H11.

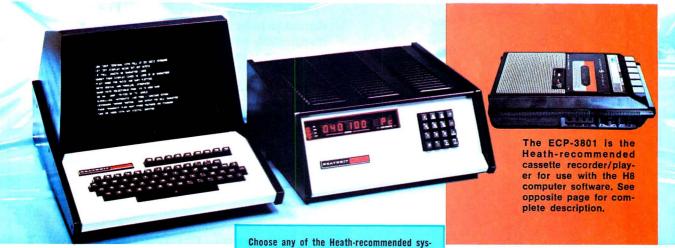
STARTREK. Startrek is perhaps the most popular computer game available. It allows you to guide, control and command the Starship Enterprise in its travels through the galaxy, fighting Klingons and solving a variety of problems. A truly challenging, sophisticated and entertaining computer game. Runs on the H8 or H11 computers with 8K of RAM or more.

GAME SET =1. This software package lets you play 8 popular computer games. These games include Craps, Orbit, Tic Tac Toe, Nim, Hexapawn, Hangman, Hmrabi, and Derby. 8K RAM or more is required on either the H8 or H11. These games will provide hours of entertainment for you and your family.

GAME SET =2. Another popular game package for the H8 and H11 computers. Contains 8 popular computer games including bagles, slot machine, gomoko, yahtze, apollo, gunner, wumpus, and cube.

AVAILABILITY. Blackjack, Biorhythm and Startrek will be available after October, 1977. Game Set #1 will be available November, 1977 and Game Set #2 available, February, 1978.

### Order a complete Heathkit computer system and SAVE!



### SYSTEM ON

The minimum recommended H8 system H8 Computer . . . . . . . . . . . . \$375 H8-1 4K Memory ..... 140 H8-3 4K Chip Set ..... H8-5 Serial I/O and Cassette Interface . . . . . . . . . . . . . 110 H9 Video Terminal ..... 530 **ECP-3801** Cassette Recorder/Player ..... 55 If purchased separately, \$1305.00

**Heath System** price is

tems shown here, the specially-priced HS-11 system below, or "roll your own" with a selection of products you choose. Any way you do it, you'll get a top-value, high-performance system, and you'll SAVE 5%! Here's how to qualify for the 5% computer systems discount:

- 1. Select either the H8 or H11 and one major peripheral (H9, H10 or LA36).
- 2. Choose the 1/0 interface, memory and software accessories you need.
- 3. Specify each in the spaces provided on the order blank.
- 4. Deduct 5% from the total price of the products (excluding shipping and handling charges).
- \*Systems illustrated already have discount prices calculated for you.

From time to time, Heath will offer specially priced total systems such as the HS-11 below. These systems will be discounted even deeper than 5% to provide you with even MORE value for your computer dollar!

### SYSTEM TWO

| Two H8-1 4K Memories 280 Two H8-3 4K Chip Sets 190 H8-5 Serial I/O and Cassette Interface 110 H8-13 Extended BASIC in Cassette Format 10 H9 Video Terminal 530 ECP-3801 Cassette | H8 Computer                  |
|--|------------------------------|
| H8-5 Serial I/O and Cassette Interface 110 H8-13 Extended BASIC in Cassette Format 10 H9 Video Terminal 530 ECP-3801 Cassette  | Two H8-1 4K Memories 280     |
| Interface  | Two H8-3 4K Chip Sets 190    |
| H8-13 Extended BASIC in Cassette Format  | H8-5 Serial I/O and Cassette |
| Cassette Format  | Interface 110                |
| H9 Video Terminal 530 ECP-3801 Cassette  | H8-13 Extended BASIC in      |
| ECP-3801 Cassette  | Cassette Format 10           |
|  | H9 Video Terminal 530        |
| Popordor/Playor EF   | ECP-3801 Cassette            |
| necorder/ Player 55  | Recorder/Player 55           |

If purchased separately, \$1550.00

Heath System price is



### SYSTEM THRE

The minimum recommended H11 system H11 Computer . . . . . . . . . \$1295 H11-1 4K Memory . . . . . . . 275 H11-2 Parallel Interface ... H11-5 Serial Interface . . . . H9 Video Terminal ...... **H10 Paper Tape** Reader/Punch .....

**Heath System** price is \$250800\*

If purchased separately, \$2640.00

### SYSTEM FOUR

SAVE EVEN MORE on this specially-priced Heath HS-11 complete computer system!

H11 Computer . . . . . . . . . \$1295 H11-1 4K Memory . . . . . . . . H11-2 Parallel Interface . . . H11-5 Serial Interface .... H<sub>10</sub> Paper Tape Reader/Punch ...... 350 H36 LA36 DEC Writer II . . . 1495

If purchased separately, \$3605.00

\$335000\*

**YOU SAVE \$255!** 



### NEW HEATHKIT SELF-INSTRUCTIONAL COMPUTER COURSES

These Heathkit self-instructional courses are designed to help you get the most from your computer investment, whether you buy your computer hardware from Heath or anywhere else. While many predeveloped software programs are available, the only way to realize the full value of your personal computer is to learn programming yourself. These courses use the PROVEN Heathkit individual learning techniques to give you a thorough understanding of programming, even if you have no prior knowledge or experience. They'll show you exactly how to make your personal computer system really personal!

### BASIC PROGRAMMING SELF-INSTRUCTIONAL COURSE

This course teaches you how to program your computer using the popular BASIC language. BASIC (Beginner's All-Purpose Symbolic Instruction Code) is essential for hobby and personal computing; it is also widely used in education and business. The course covers all formats, commands, statements and procedures plus the creative aspects of computer programming, so you can make practical use of it in solving problems and creating your own unique programs. Like other Heathkit self-instructional courses, it uses programmed instructions backed by practical hands-on computer experiments and demonstrations to reinforce and personalize the text material. An optional final exam (passing grade 70%) brings you a Certificate of Achievement and 3.0 Continuing Education Units\*. While the BASIC course is keyed to Heathkit computers, it is also equally applicable to any computer system using BASIC. Available after Oct. 20th, 1977.

### **COMING SOON!**

8080 Programming: Teaches you the machine and assembly language used with 8080-based computers. Shows you how to use the editor, assembler and debug software to create efficient programs. Ideal for the H8 and other 8080A based machines. Coming soon.

LSI-11 Programming: Shows you how to use editor, assembler, linker, debug and executive I/O software to create efficient programs. Applicable to H11 and most other Digital Equipment Corporation PDP-11 series computers. Coming soon.

### **COMING IN OCTOBER!**

### MICROPROCESSOR SELF-INSTRUCTIONAL COURSE



Learn how microprocessors operate and how to design with them. Covers applications, machine language programming, hardware I/O interfacing and much more. The course includes all IC's needed to perform exciting experiments. The microprocessor trainer used with the course features the popu-

lar 6800 microprocessor plus 256 bytes of RAM, a 1K ROM monitor, 6-digit hexadecimal display and hexadecimal keyboard. The Heathkit microprocessor course/trainer combo is the fast, easy low-cost way to learn about these important devices. Watch for it in our next catalog!

### **GENERAL COMPUTER BOOKS**

TV Typewriter Cookbook (Sams). Good text explaining I/O terminals, interfacing, etc. EDP-226 9.95

### **8080 BOOKS**

Build a library to support your H8 computer or any 8080 based machine.

 8080 Software Gourmet Guide and Cookbook (Scelbi). Excellent source for 8080 programs and subroutines. EDP-228 ......9.95

Practical Microcomputer Programming: 8080 (Northern Technology). Machine/Assembly programming concepts for the 8080.

EDP-235 ......21.95

### **6800 BOOKS**

Great reference sources for your 6800 based computers.

6800 Software Gourmet Guide and Cookbook (Scelbi). Excellent source of commonly used 6800 programs. EDP-233 .....9.95

6800 Microprocessor Programming Manual (Motorola). Programming principles and examples for the 6800. EDP-245 ......10.00

### H11/LSI-11/PDP-11 BOOKS

Here are several important reference sources to help you get the most value from your H11 Computer.

 Operation, programming and applications of PDP-11 computers. **EDP-246** ......**19.50** 

### GENERAL PROGRAMMING AND APPLICATIONS BOOKS

101 BASIC Computer Games (DEC). A classic. Have fun with your computer. EDP-237. 7.50 BASIC Software Library, Vol. I. Complete lists of BASIC applications programs book-

keeping, games, pictures (graphics).
EDP-240 ......24,95

BASIC Software Library, Vol. II. Math, engineering, plotting and statistical programs in BASIC. EDP-241 .......24.95

BASIC Software Library, Vol. IV. Games and business applications programs in BASIC. EDP-243 .....9.95

BASIC Software Library, Vol. V. Games, graphics, and useful math programs in BASIC. EDP-251 .....9.95

Heathkit 14

HEATH

Schlumberger

To remove order form cut out entire page along dotted line.

## **ORDER FORM**

### Agreement

| designated for future delivery Heath  |   | nave checked below. I understand tha<br>within 30 davs of those availability dat | •        |
|---|---|--|--|
| H8 Computer at \$375.00 each plus   |   | H11-6 Extended Arithmetic Chip at  |  |
| ☐ handling.☐ Qty. ☐ H8-1 4K Memory plus \$1.15 shipping and handling.             | (s) at \$140.00 each                              | shipping and handling.  HM-1100 Manual Set at \$25.00 each and handling.         | h plus \$2.50 shipping                         |
| Qty H8-3 4K Chip Se plus \$1.15 shipping and handling.                            | t(s) at \$95.00 each                              | H9 Video Terminal at \$530 each  | plus \$7.64 shipping                           |
| ☐ plus \$1.15 shipping and handling.☐ H8-2 Parallel Interface at \$150.00 e       |   | ☐ and handling. ☐ H10 Paper Tape Reader/Punch at                                 | \$350 each plus \$4.96                         |
| ping and handling.  |   | shipping and handling.   |  |
| H8-5 Serial I/O Cassette Interface a shipping and handling.                       | t \$110.00 plus \$1.15                            | H10-2 Three Rolls Paper Tape at \$ ping and handling.                            |  |
| H8-13 Extended BASIC Cassette a \$1.15 shipping and handling.                     | t \$10.00 each plus                               | H10-3 Three boxes Fan-fold Paper \$1.15 shipping and handling.                   | Tape at \$10.00 plus                           |
| H8-14 Extended BASIC on paper t plus \$1.15 shipping and handling.                | ape at \$10.00 each                               | H36 DEC Writer II at \$1495 (No CC shipping information.)                        | DD's, see page 12 for                          |
| H8-15 Paper Tape Systems Softwa each plus \$1.15 shipping and hand                | re for H8 at \$20.00                              | H36-1 Fan-fold Paper at \$30.00 plu handling.                                    | s \$7.76 shipping and                          |
| HM-800 Manual Set at \$25.00 each   |   | H36-2 E1A Interface at \$65.00 each  | n plus \$1.15 shipping                         |
|   | \$5.52 shipping and                               | ☐ and handling. ☐ ECP-3801 Cassette Recorder/Playe                               | er at \$55.00 each plus                        |
| ☐ Light Handling. ☐ Qty. ☐ H11-1 4K Memory  | (s) at \$275.00 each                              | \$1.69 shipping and handling.  ECP-3802 Cassette Recording Ta                    |  |
| ☐ plus \$1.15 shipping and handling.  |   | \$5.00 plus \$1.15 shipping and hand   | dling per pkg.                                 |
| H11-2 Parallel Interface at \$95.00 early ping and handling.                      | ach plus \$1.15 ship-                             | EC-1100 BASIC Programming Co<br>\$1.69 shipping and handling. Ava                | ourse at \$29.95 plus<br>ilable after October. |
| H11-5 Serial Interface at \$95.00 ea  | ch plus \$1.15 ship-                              | HS-11 Special Priced Complete S plus \$14.00 shipping and handling.              | vstem at \$3350 each                           |
| Please send the following Computer  |   | Note: The H11 and all its accesso  |  |
| └ total \$10.00 minimum) postpaid (Pr   | int numbers plainly.)                             | November 10th, 1977.   |  |
|   |   |  |  |
|   |   |  |  |
| HEATH REVOLVING charged-kit   |   | money order for \$(  | Michigan residents add 4% sales tax.)          |
| CHARGE PLAN   |   | /Bankamericard ☐ Master Charge<br>Exp. Date_                                     |  |
| You may purchase Heathkit   |   | Code No.   |  |
| products on our convenient Re-<br>volving Charge Plan. No money                   | ☐ Add on to or reopen m<br>(\$1500 maximum accoun | ny existing Heathkit Charge Account. No.   |  |
| down and up to two years to   | (\$1500 maximum accoun                            | t balance.)  |  |
| pay. Up to \$1500 maximum account balance.  | Signature   | (necessary to ship merchandise)  |  |
| ☐ I would like to open a Heath  | Name  |  |  |
| Revolving Charge Account.   |   |  |  |
| Please rush me the neces-<br>sary application forms when                          | Address   |  |  |
| you receive this order.   |   | State  |  |
|   | BR-119 All prices net F.O.E                       | 3. Benton Harbor, Mi. Prices and specificati                                     | ons subject to change without notice           |
|   | ATU/DEC Coffee                                    | ve License Aureement   |  |
|   |   | are License Agreement: any your H11 computer order.                              |  |
| CUSTOMER SUBLICENSE GRAN  |   |  |  |
| HEATH COMPANY (hereinafter referred   | o as HEATH) pursuant                              | OF MERCHANTABILITY AND FIT warranties are in lieu of all oblig                   |  |
| to a license agreement with Digital Equipm  |   | of either DIGITAL or HEATH for   | damages, including but not                     |
| inafter referred to as DIGITAL) does here<br>a non-transferable and non-exclusive |   | limited to special, indirect or co<br>out of or in connection with the           |  |
| Binary Software Program(s) PTSP-11  | Paper Tape System,                                | Software licensed hereunder.   | ,  |
| FOCAL/PTS Language Processor, BASIC essor (hereinafter singularly and/or coll     | ectively referred to as                           | This Sublicense Grant, the license Software may not be assigned                  | es granted hereunder and the                   |
| "Software") on the following terms and co   | onditions.  | prior written consent from DIGITA  |  |
| DESCRIPTION OF SOFTWARE:  |   | the Software, in whole or in part otherwise provided herein.                     | is granted hereby except as                    |
| Software is furnished to CUSTOMER for only and may be modified, or copied         | (with the inclusion of                            | HEATH COMPANY  | 1 1  |
| DIGITAL'S copyright notice) only for us   | se on such CPU. The                               | HEATH COMPANY  | & Int  |
| CUSTOMER shall not provide or otherw<br>Software or any portion thereof in any f  | orm to any third party                            | By   | De Johnson                                     |
| without the prior approval of DIGITAL. of the Software shall at all times remain  | Title to the ownership                            | CUSTOMER   |  |
| DIGITAL AND HEATH JOINTLY AND S   | EVERALLY DISCLAIM                                 |  | V  |
| ALL IMPLIED WARRANTIES WITH REC<br>WARE LICENSED HEREUNDER, INCLUD                | NG ALL WARRANTIES                                 | ByCustomer's S   | ignature                                       |
|   |   |  |  |

# Heathkit is the name to look for in quality electronic kits



Heath Company, located on the shores of Lake Michigan near Benton Harbor, is the world's largest manufacturer of electronic kits. Heathkit products are marketed primarily through the Heathkit Mail Order Catalog, published 5 times a year, and a nation-wide chain of Heathkit Electronic Centers (Units of Schlumberger Products Corporation).



In addition to this new line of personal computing products, Heath Company offers nearly 400 other electronic kits of virtually every description. Product categories include Amateur Radio, Automotive Accessories, Stereo Hi-fi Components, Test Instruments, Color TV, Boating and Marine Accessories, Leisure and Home Improvement Products, and our awardwinning self-instruction programs. Every Heathkit product is supplied with a comprehensive step-bystep instruction manual that tells you all you need to know, from unpacking the kit to plugging it in. These manuals are world-famous for their clarity, accuracy and precision. Let Heath show you how easily you can put together superior quality electronic products. Send for your FREE copy of our latest catalog!

Heathkit Computer Systems are also sold and serviced through 47 Heathkit Electronic Centers nationally (Units of Schlumberger Products Corporation) at slightly higher prices. Check the white pages of your telephone directory for the Heathkit Electronic Center nearest you.

Canadian Customers: Contact the Heathkit Electronic Center in most major cities or write for Canadian Prices to:

Heath Company, A Division of Schlumberger Canada, Ltd. 1480 Dundas Street E. Mississauga, Ontario L4X 2R7





## **LOCAL SIDEREAL TIME & DATE**

### by James J. Brennan

1900 DS=86400! 1905 DX=86636.55536#

1910 HS=3600

### DESCRIPTION

The following BASIC application program calculates the Greenwich Mean Time (GMT), Greenwich Sidereal Time (GST), Greenwich Sidereal Date (GSD), Julian Date (JD), corrected Local Mean Time (LMT), and Local Sidereal Time (LST).

```
PROGRAM
 10 PRINT
40 PRINT" ASTRON 2
50 PRINT"A PROGRAM TO DO ASTRONOMICAL COMPUTATIONS FOR YOU
 60 PRINT
70 REM INITIALIZE THE PROGRAM
80 GOSUB 1000
90 REM GET THE REQUIRED INFORMATION FOR THE CALCULATIONS
100 GOSUB 2000
100 GOSUB 2000
100 GOSUB 7000
100 GOSUB 
 110 REM CALCULATE THE NUMBER OF ELAPSED DAYS FROM THE BASE 120 REM DATE TO THE DATE IN QUESTION 130 GOSUB 3000
 140 REM CALCULATE THE JULIAN DATE (AT 0 HRS U.T.) FOR 150 REM THE DATE IN QUESTION. (AT GREENWITCH LONGITUDE)
  160 GOSUB 4000
 170 REM CALCULATE THE SIDEREAL DAY
 180 GOSUB 5000
190 REM CALCULATE THE GREENWITCH SIDEREAL TIME
 200 GOSUB 6000
```

```
210 REM CALCULATE THE GREENWITCH MEAN TIME GIVEN THE LOCAL
220 REM CIVIL TIME AND TIME ZONE 230 GOSUB 7000
240 REM CONVERT THE GREENWITCH SIDEREAL TIME ACCOUNT FOR THE ACTUAL GMT
250 GOSUB 8000
260 REM CONVERT GMT TO LMT
270 GOSUB 9000
280 REM CONVERT GMT TO LOCAL SIDEREAL TIME
290 GOSUB 10000
899 REM PRINT OUT THE DATA THAT WAS CONPUTED
900 GOSUB 20000

1000 REM INITIALIZATION SUBROUTINE

1001 DEFDBL A-H

1002 DEFDBL J-Z

1799 C=.0666667#:REM 1"LONGITUDE= C SECONDS OF SOLAR TIME

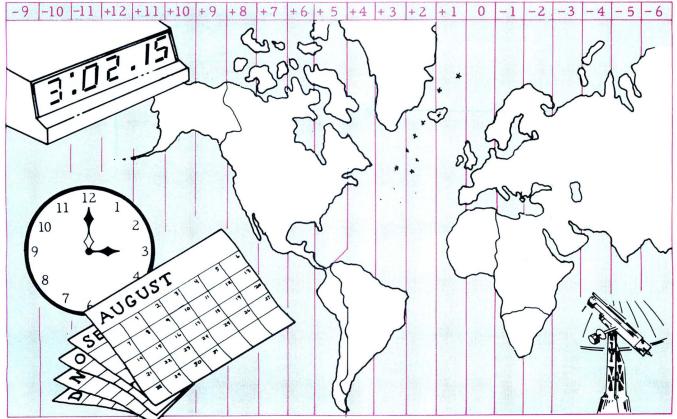
1800 C1=76

1810 C2=1.0027379093#

1820 C3=.9972695664#

1830 C4=244

1840 C5=3000.5
900 GOSUB 20000
1845 C5A=2443000.5#
1850 C6=244
1860 C7=9690
1861 C7A=2.44969E+06
1870 C8=8
1880 C9=10
1890 C10=76
```



```
20010 PRINT:PRINT:PRINT
20020 PRINT"FOR THE CIVIL DATE ";M;D;Y
20030 PRINT"AND THE CIVIL TIME "CH;CM;CS;CZ$
20040 PRINT:PRINT"AT A LONGITUDE OF ";DL;ML;SL
20050 PRINT:PRINT"THE FOLLOWING INFORMATION APPLIES:"
20058 IF GH+0 THEN GH=GH+24
20059 IF GH+>24 THEN GH=GH+24
20060 PRINT:PRINT:PRINT"THE GREENWICH MEAN TIME (OR U.T.) IS "GH;GM;GS
20068 IF SH<0 THEN SH=SH+24
20069 IF SH+>24 THEN SH=SH+24
20070 PRINT:PRINT"THE GREENWICH SIDEREAL TIME IS ";SH;SM;INT(SS)
20080 PRINT:PRINT"THE GREENWICH SIDEREAL DATE IS ";SD
20090 PRINT:PRINT"THE JULIAN DAY IS ";JD
20090 IF LH+0 THEN LH+LH+24
20090 IF LH+0 THEN LH+LH+24
20090 IF LH+0 THEN LH+LH+24
20100 PRINT:PRINT"THE LOCAL MEAN TIME (CORRECTED FOR
20110 PRINT"PRINT"THE LOCAL SIDEREAL DAY IS ";W2
20120 PRINT:PRINT"THE LOCAL SIDEREAL DAY IS ";W2
20120 PRINT:PRINT"THE LOCAL SIDEREAL TIME IS ";W3;W4;INT(W5)
OK
  1920 MS=60
 1930 S=S
 1940 SX=2449690#
  1999 RETURN
  2000 REM SUBROUTINE TO GET THE REQUIRED INFORMATION
2000 REM SUBROUTINE TO GET THE REQUIRED INFORMATION
2010 PRINT"ENTER THE MONTH, DAY, AND THE LAST TWO NUMBERS OF THE
2020 PRINT"YEAR IN QUESTION. DONT FORGET THE COMMAS!
2030 PRINT"WHAT IS THE DATE";:INPUT M,D,Y
2040 PRINT:PRINT"ENTER THE LOCAL CIVIL TIME HOUR, MINUTE, AND
2050 PRINT"SECOND (DON'T FORGET THE COMMAS)! WHAT IS THE LOCAL
2060 PRINT"CIVIL TIME";:INPUT CH,CM,CS
2062 PRINT:PRINT"WHAT IS THE CIVIL TIME ZONE (PST OR PDT)";
 2062 PRINT:PRINT WHAT IS THE CLAIR THE ASSOCIATION ASSOCIATION OF THE PRINT STATEMENT OF THE PLACE IN QUESTION 2080 PRINT" OF LONGITUDE OF THE PLACE IN QUESTION 2090 PRINT" (AGAIN, DONT FORGET THE COMMAS!) 2100 PRINT WHAT IS THE LONGITUDE";:INPUT DL,ML,SL
  3000 REM ROUTINE TO CALCULATE THE NULMBER OF ELAPSED DAYS 3010 REM FROM THE BASE DATE TO THE DATE IN QUESTION 3020 DIM T(13)
                                                                                                                                                                                                                                                                     OK
  3060 DATA 31,28,31,30,31,30,31,31,30,31,30,31
3090 D3=0
3100 IF C8>2 THEN 3130
3115 IF INT(C10/4)-(C10/4)<>0 THEN 3130
3120 D3=1
                                                                                                                                                                                                                                                                      1000 REM INITIALIZATION ROUTINE
1001 REM THE FOLLOWING REMARKS STATEMENTS CONTAIN THE
1002 REM BASIC ASTRONOMICAL TIMEKEEPING INFORMATION
1003 REM USED IN THIS PROGRAM (FOR INFORMATION ONLY)
1010 REM GST-GREENWITCH SIDEREAL TIME
1020 REM GMT-GREENWITCH MEAN TIME
1030 REM UT=UNIVERSAL TIME (ANOTHER NAME FOR GMT)
 3120 D3=1
3130 FOR I=1 TO 12
3140 READ T(I)
3160 NEXT I
3170 D3=T(C8)-C9+D3
3200 FOR I=C8+1 TO 12
3210 D3=T(I)+D3
3220 NEXT I
3260 N2-C10
                                                                                                                                                                                                                                                                      1030 REM UT=UNIVERSAL TIME (ANOTHEI
1040 REM LMT=LOCAL MEAN TIME
1050 REM LCT=LOCAL CIVIL TIME
1060 REM LST=LOCAL SIDERIAL TIME
1070 REM GHA-GREENNITCH HOUR ANGLE
1080 REM LHA-LOCAL HOUR ANGLE
1090 REM RA=RIGHT ASCENSION
1100 REM LST=RA (AT UPPER TRANSIT)
1110 REM LST=RA+LHA
1120 REM LHA-ICT-PA
  3220 NEXT 1
3260 Y3=C10
3265 Y3=Y3+1
3280 IF Y3>=Y THEN 3370
3310 IF INT(Y3/4)-(Y3/4)=0 THEN 3340
3315 D3=D3+365
                                                                                                                                                                                                                                                                    1110 REM LST=RA+LHA
1120 REM LHA-LST-RA
1130 REM LHA-LST-RA
1130 REM LST=LHA ARIES
1140 REM GST=GHA ARIES
1150 REM GST=LST+WEST LONGITUDE CONVERTED TO TIME
1160 REM GST=LST-EAST LONGITUDE CONVERTED TO TIME
1170 REM GMT=LMT-EAST LONGITUDE CONVERTED TO TIME
1180 REM GMT=LMT-EAST LONGITUDE CONVERTED TO TIME
1190 REM 1" LONGITUDE= 0.666667 SECONDS OF SOLAR TIME
1200 REM 1" LONGITUDE= 4 SECONDS OF SOLAR TIME
1210 REM 1 DEGREE LONGITUDE= 4 MINUTES OF SOLAR TIME
1220 REM 15 DEGREES LONGITUDE= 1 HOUR OF SOLAR TIME
1230 REM 24 HOURS OF SIDEREAL TIME IS EQUAL TO
1240 REM 23 HOURS,56 MIN, 04.1 SEC OF SOLAR TIME
  3325 GOTO 3245
3340 D3=D3+366
3340 D3=D3+366
3350 GOTO 3265
3370 IF M<=2 THEN 3400
3380 IF INT(Y/4)-(Y/4)<>0 THEN 3400
3390 D3=D3+1
3400 FOR I=1 TO-M-1
3410 D3=T(I)+D3
3420 NEXT I
3430 D3=D+D3
3440 IF C10=Y THEN D3=D3-366
3445 IF M<=2 THEN D3=D3-31
3999 RETURN
4000 REM ROUTINE TO CALCULATE THE JULIAN DATE
4010 REM THE JULIAN DATE FOR THE BASE DATE OF
4020 REM AUGUST 10, 1976 IS 2,443,000.5
4030 REM AT 0 HRS U.T. AT GREENWITCH
4050 JD=C5A+D3
4999 RETURN
5000 REM ROUTINE TO CALCULATE THE SIDEREAL DAT
                                                                                                                                                                                                                                                                       1250 REM
                                                                                                                                                                                                                                                                       1250 REM 24 HOURS OF MEAN SOLAR TIME IS EQUAL TO
1270 REM 24 HOURS, 03 MIN, 56.6 SEC OF SIDEREAL TIME
                                                                                                                                                                                                                                                                       1280 REM
                                                                                                                                                                                                                                                                       1290 REM FOR EACH 1 HOUR OF SIDEREAL TIME, 1 HOUR OF 1300 REM MEAN SOLAR TIME IS 9.83 SEC SHORTER
                                                                                                                                                                                                                                                                       1310 REM
  4999 RETURN
5000 REM ROUTINE TO CALCULATE THE SIDEREAL DATE IN TOTAL SECONDS
5010 REM AT 0 HRS U.T. ON THE DATE IN QUESTION
5030 REM SD=2449690.0 ON AUG 10 1976
5060 ST=SX * DS
5090 SY=ST+D3*DX
                                                                                                                                                                                                                                                                      1320 REM FOR EACH 1 HOUR OF MEAN SOLAR TIME, 1 HOUR OF 1330 REM SIDEREAL TIME IS 9.87 SECOND LONGER
                                                                                                                                                                                                                                                                       1340 REM
                                                                                                                                                                                                                                                                    1340 REM
1350 REM 1 SOLAR SECOND=1.00273791 SIDEREAL SECONDS
1360 REM 1 SIDEREAL SECOND=0.997270 SOLAR SECOND
1370 REM FIRST POINT OF ARIES IS ABOUT MARCH 21
1380 REM SUMMER SOLSTICE IS ABOUT JUNE 22
1390 REM AUTUMNAL EQUINOX IS ABOUT SEPT 23
1400 REM WINTER SOLSTICE IS ABOUT BEC 22
1410 REM FPA TO FPA IS 365 DAYS,05 HOURS,48 MIN,46 SEC
1420 REM AND IS CALLED THE TROPICAL YEAR
  5090 SY=SY+D3*DX
5999 RETURN
6000 REM ROUTINE TO CALCULATE THE GREENWITCH SIDEREAL TIME
6010 REM THE GST AT 0 HRS U.T. ON THE BASE DATE OF
6020 REM AUG 10,1976 WAS 21 HOURS, 14 MINUTES, 23.155 SEC.
6030 REM (MEAN SIDEREAL TIME)
  6050 SZ=SY+(21*HS+14*MS+23.155)
 6050 SZ=SY+(21*HS+14*MS+23.155)
6999 RETURN
7000 REM CALCULATE THE ACTUAL GREENWICH MEAN TIME FOR THE
7010 REM CIVIL TIME ENTERED
7030 CT=CH*HS+CM*MS+CS
7040 IF CT=>24*HS THEN 7500
7080 IF CZ$<"PST" THEN 7600
7090 IF CZ$="PST" THEN GT=CT+8*HS: REM ADD 8 HOURS
7100 IF CZ$="PDT" THEN GT=CT+7*HS: REM ADD 7 HOURS
7140 GR=GT-(GH*HS)
                                                                                                                                                                                                                                                                         RUN
                                                                                                                                                                                                                                                                                                                                   ASTRON 2
                                                                                                                                                                                                                                                                       A PROGRAM TO DO ASTRONOMICAL COMPUTATIONS FOR YOU
                                                                                                                                                                                                                                                                         ENTER THE MONTH, DAY, AND THE LAST TWO NUMBERS OF THE YEAR IN QUESTION. DON'T FORGET THE COMMAS! WHAT IS THE DATE? 7,9,77
  7140 GR=GT-(GH*HS)
7150 GM=INT(GR/MS)
                                                                                                                                                                                                                                                                       ENTER THE LOCAL CIVIL TIME HOUR, MINUTE, AND SECOND (DON'T FORGET THE COMMAS)! WHAT IS THE LOCAL CIVIL TIME? 11,45,30
  7160 GR=GR-(GM*MS)
   7170 GS=GR
 7499 RETURN
7500 PRINT"THERE WAS AN ERROR IN THE CIVIL TIME THAT YOU ENTERED
7510 PRINT"PLEASE RE-ENTER THE LOCAL TIME IN HRS, MIN, SEC
7520 PRINT"HAT IS THE CIVIL TIME";:INPUT CH, CM, CS:GOTO 7000
7600 IF CZS="PDT"THEN 7100 ELSE 7610
7610 PRINT:PRINT:PRINT" RE-ENTER THE TIME ZONE. IT CAN ONLY BE PST
7620 PRINT" OR PDT. WHICH IS IT";:INPUT CZ$:GOTO 7080
8000 REM CONVERT GREENWITCH SIDEREAL TO ACCOUNT FOR THE
8010 REM ACTUAL GMT
8020 SZ=SZ+GS
8040 SDEINT(SZ/DS):SR=SZ-(SD*DS):SH=INT(SB/HS):SP=SP-(SH*HS)
   7499 RETURN
                                                                                                                                                                                                                                                                        WHAT IS THE CIVIL TIME ZONE (PST OR PDT)? PDT
                                                                                                                                                                                                                                                                       ENTER THE DEGREES, SECONDS, AND MINUTES OF LONGITUDE OF THE PLACE IN QUESTION (AGAIN, DONT FORGET THE COMMAS!) WHAT IS THE LONGITUDE? 121,07,30
  8040 SD=INT(SZ/DS):SR=SZ-(SD*DS):SH=INT(SR/HS):SR=SR-(SH*HS)
8050 SM=INT(SR/MS):SR=SR-(SM*MS):SS=SR
8999 RETURN
                                                                                                                                                                                                                                                                       FOR THE CIVIL DATE 7 9 77
AND THE CIVIL TIME 11 45 30 PDT
  9000 REM CONVERT GMT TO LMT
9020 TL=DL*HS+ML*MS+SL
                                                                                                                                                                                                                                                                       AT A LONGITUDE OF 121 7 30
  9040 TZ=TL*C

9040 TZ=TL*C

9060 LT=GT-TZ

9080 LH=INT(LT/HS)

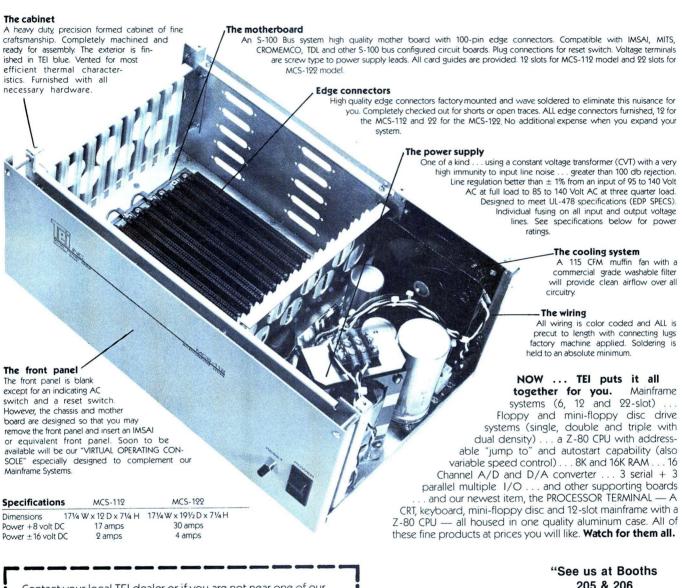
9090 LR=LT-(LH*HS)

9100 LM=INT(LR/MS)
                                                                                                                                                                                                                                                                       THE FOLLOWING INFORMATION APPLIES:
                                                                                                                                                                                                                                                                       THE GREENWICH MEAN TIME (OR U.T.) IS 18 45 30
                                                                                                                                                                                                                                                                       THE GREENWICH SIDEREAL TIME IS 19 7 46
  9110 LR=LR-(LM*MS)
  9120 LS=LR
9999 RETURN
                                                                                                                                                                                                                                                                       THE GREENWITCH SIDEREAL DATE IS 2450024
 9999 RETURN
10000 REM ROUTINE TO CONVERT GMT TO LOCAL SIDEREAL TIME
10080 W1=SZ-(TZ*1.0027379093#)
10090 W2=INT(W1/DS):REM DAYS
10100 W6=W1-(W2*DS):REM SEC REMAINING
10110 W3=INT(W6/HS):REM HOURS
10120 W6=W6-(W3*HS):REM SEC REMAINING
10130 W4=INT(W6/MS):REM MIN
10140 W6=W6-(W4*MS):REM SEC REMAINING
10150 W5=W6:REM SECONDS OF LOCAL SIDEREAL TIME
10150 W5=W6:REM SECONDS OF LOCAL SIDEREAL TIME
100000 REM ROUTINE TO PRINT OUT THE DATA COMPUTED
                                                                                                                                                                                                                                                                       THE JULIAN DAY IS 2443333.5
                                                                                                                                                                                                                                                                       THE LOCAL MEAN TIME (CORRECTED FOR LONGITUDE 121 7 30 ) IS 10 40 59
                                                                                                                                                                                                                                                                      THE LOCAL SIDEREAL DAY IS 2450024
                                                                                                                                                                                                                                                                      THE LOCAL SIDEREAL TIME IS 11 1 56
```

## Computer Mainframe System

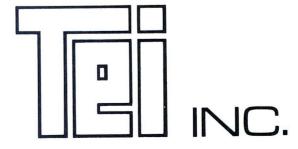
First in the TEI family . . . The MCS-112 and 122 Mainframe Systems.

### "The Base on Which to Build"



Contact your local TEI dealer or if you are not near one of our dealers, write or call CMC MARKETING CORP direct for more information. (DEALER INQUIRIES INVITED) PLEASE SEND ME: ☐ MCS-112 Kit @ 395.00 ☐ MCS-112 Assembled @ 445.00 ☐ MCS-122 Assembled @ 575.00 ☐ MCS-122 Kit @ 495.00 Texas residents add 5% Sales Tax I Enclose Check ☐ or Money Order ☐ CMC MARKETING CORP 7231 Fondren Rd, Houston, TX 77036 Telephone (713) 774-9526

205 & 206 in Boston"





## A KIM-1 SIDEREAL/SOLAR CLOCK

by John O. Bumgarner

This program includes both major and minor timing loops and can be tuned to run accurately with a wide range of clock frequencies. This program will also fit nicely into the KIM-1 scratch pad area.

Adjusting the clock rate by time fillers is an example of "fixing it in the software" rather than electronically adjusting the crystal clock rate. The fillers at locations 0216 and 0218 provide a 4  $\mu$ sec. to 12  $\mu$ sec. range of delays depending on the instructions loaded here. A 1  $\mu$ sec. change in this delay results in about 19.82 seconds per day change in the clock rate. Inspection of the MCS 650X Instruction Set Summary Card shows several 2-byte instructions with execution times of from 2  $\mu$ sec. to 6  $\mu$ sec. The instructions chosen should not modify the time stored at locations 0020, 0021, 0022, the X register or the decimal mode bit.

The minor timing loop has the delay formula

Delay =  $6 + 5(N-1) + V \mu sec.$  where

6 = 2 + 4, 2  $\mu$ sec. for the load X,

4 usec. for the loop without a branch

 $5 = loop time with a branch, \mu sec.$ 

N = loop count, \$01 to \$FF or \$00

 $V = variable time filler 2 \mu sec. to 6 \mu sec.$ 

The delay introduced by this timing loop will vary from 8  $\mu$ sec. (N = 1, V = 2  $\mu$ sec.) to 1282  $\mu$ sec. (N = 255, V = 6  $\mu$ sec.). The loop will go 1287  $\mu$ sec. if N = 00 since X is decremented to 255 before testing.

An example: Suppose you determine that your KIM-1 is running 10.63 seconds/day fast by observing it against a time standard such as WWV. Patient observation over several weeks will be necessary if the KIM-1 is close to the desired rate. The number of microseconds to delay per second is:

$$\frac{10.63 \times 10^6}{60 \times 60 \times 24} = \frac{10630000}{86400} = 123.03 \text{ or } 123 \,\mu\text{sec. per second}$$

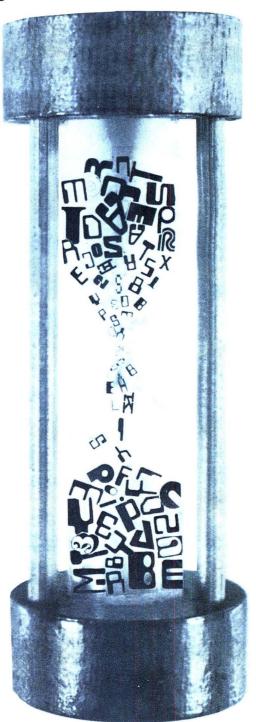
The loop parameters are found this way:

123 - 6 = 117 (the fixed delay amount)

$$\frac{117}{5}$$
 = 23.4 (23 loops plus 0.4 x 5 = 2  $\mu$ sec. more),  $23_{10}$  =  $17_{16}$  .

The loop parameters would be \$17 at location 021E and the filler would be 2  $\mu$ sec. — say a LDY immediate instruction. By choosing the loop count and filler appropriately any delay in the range of the loop can be achieved to the nearest microsecond. A change of one microsecond in this loop will result in a change in the clock rate of 0.0864 seconds per day or about 30 seconds per year.

The KIM-1 programmable internal timers could be used for both the major and minor delays but require "watching" the timer or the wiring of the interrupt lines on the KIM-1 and are not so simple to tune as the delay loops.



The crystal clock rate can be accurately adjusted to the nearest microsecond by "fixing" it in the KIM-1 software fillers.

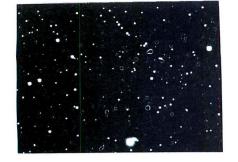
| HEX ADDR | CODE     | LABEL |     |        | COMMENTS  |
|----------|----------|-------|-----|--------|---|
| 0200     | A2E9     | L1    | LDX | \$E9   | Load X with timing loop count, Note 1.                                    |
| 2        | d8       |       | CLD |        | Clear decimal mode.   |
| 3        | A520     | L2    | LDA | HR     |   |
| 5        | 85Fb     |       | STA | Fb     |   |
| 7        | A521     |       | LDA | MI     |   |
| 9        | 85FA     |       | STA | FA     | Move time to display area. Note 2   |
| b        | A522     |       | LDA | SE     | major   |
| d        | 85F9     |       | STA | F9     | timing  |
| 020F     | 8623     |       | STX | T1     | Save loop count. Note 2   |
| 0211     | 20 1F 1F |       | JSR | SCANDS | Jump to KIM-1 display subroutine.   |
| 4        | A623     |       | LDX | T1     | restore loop count.   |
| 6        | A100     |       | LDA | (0,X)  | )   |
| 8        | A100     |       | LDA | (0,X)  | Note 3.   |
| Α        | CA       |       | DEX |        | decrement loop count.   |
| b        | d0E6     |       | BNE | L2     | Branch to loop head if $X \neq 0$ .                                       |
| d        | A216     |       | LDX | \$90   | Load X with timing loop count. Note 6.                                    |
| 021F     | CA       |       | DEX |        | Decrement loop count.   |
| 0220     | d0Fd     |       | BNE | *-1    | If $X \neq 0$ , go back one line. $\blacktriangleright$ minor timing loop |
| 2        | b500     |       | LDA | 0,X    | >Note 4.  |
| 4        | F8       |       | SED |        | Set decimal mode for arithmetic. establish &                              |
| 5        | 18       |       | CLC |        | Clear carry bit.   Clean environment                                      |
| 6        | A522     |       | LDA | SE     | Pick up seconds count.  |
| 8        | 6901     |       | ADC | \$01   | Add one to it.  |
| Α        | 8522     |       | STA | SE     | Put it back.  |
| С        | C960     |       | CMP | \$60   | Compare seconds count to sixty.   |
| 023E     | d0d0     |       | BNE | L1     | If seconds not equal to sixty, to to the start. Note 5.                   |
| 0        | 8622     |       | STX | SE     | Set seconds count to zero (X is zero here).                               |
| 2        | A521     |       | LDA | MI     | Pick up minutes count.  |
| 4        | 6900     |       | ADC | \$00   | Add one to it (the CMP at 022C set the carry bit on                       |
|          |          |       |     |        | equal).   |
| 6        | 8521     |       | STA | MI     | Put it back.  |
| 0238     | C960     |       | CMP | \$60   | Compare seconds count to sixty.   |
| Α        | d0C4     |       | BNE | L1     | If minutes not equal to sixty, go to start.                               |
| С        | 8621     |       | STX | MI     | Set minutes to zero.  |
| 023E     | A520     |       | LDA | HR     | Pick up the hours count.  |
| 0240     | 6900     |       | ADC | \$00   | Add one to it.  |
| 2        | 8520     |       | STA | HR     | Put it back.  |
| 4        | C924     |       | CMP | \$24   | Compare hours to 24. Note 6.  |
| 6        | d0b8     |       | BNE | L1     | If hours not equal to 24, go to the start.                                |
| 8        | 8620     |       | STX | HR     | Set hours to zero.  |
| 024A     | F064     |       | BEQ | L1     | Go to start.  |
|          |          |       | END | @0200  |   |

### NOTES:

- 1. For regular time rate (UT or solar rate) load \$EA instead of \$E9.
- 2. Zero page locations used: 0020 for seconds, 0021 for minutes, 0022 for hours and 0023 temporary.
- These two instructions are timing fillers. The two above are a 12μsec delay for sidereal time. For solar time my KIM-1 needs a delay of 8μsec and I use E6 23 A523 (INC T1, LDA T1) here.
   This instruction is a time filler. It will probably be different in your KIM-1 for sidereal or solar rate, see text.
- 5. The compare instruction just before this branch sets the carry bit on equal compare. Therefore when seconds equal sixty the branch is not taken and adding zero later results in adding one due to the carry.
- 6. For solar time on my KIM-1 this constant is \$16 instead of \$90.
- 7. For 12 hour clock use the following code:

| 0244 | C913 | CMP | \$13  | Compare hours to thirteen.                       |
|------|------|-----|-------|--|
| 6    | dob8 | BNE | L1    | If hours not equal to thirteen, go to the start. |
| 8    | E8   | INX |       | increment X. X is not \$01.                      |
| 9    | 8620 | STX | HŘ    | Store X in hours.                                |
| 024b | Fob3 | BNE | L1    | Go to start.                                     |
|      |      | END | @0200 |  |

8. To run, load the time, HR:MI:SE, in 20 to 22 on page zero and GO at address 0200.



# SOLAR ECLIPSE PREDICTION BY MICROCOMPUTER

by Nickey Naumovich, Jr.

It was almost two o'clock in the afternoon, and I was trying hard to be "cool" and above disappointment while I plotted an eclipse for a guy who lived somewhere in Montana. The scene was my booth at the Personal Computer Fair of the National Computer Convention in Dallas, and it was June 14th, time for awards to be announced. Me? I'm Nickey Naumovich, Jr., just turned 16, a junior in high school, and I like cars, girls, computers, photography and astronomy — in that order.

My interests in astronomy, computers, and photography have all grown together, and my participation in the N.C.C. Computer fair, which combined those three interests, was a thrill for me. I was lucky; I got fourth place award and was youngest of the winners.

My interest in computers goes back to the summer I was 12 and worked some in a computer room on an IBM 360 Mod 65. I got interested in astronomy that same year when a friend of my Dad's, Nickey Sr., wanted help with plotting the constellations on the inside dome of a building for his school. Since then, much study and research and the advent of the microcomputer led to my project which I called "Prediction of Solar Eclipses by Microcomputer" and presented at the Computer Fair.

This is really the story of two interests which converged, and the astronomy started first, because of photography. After I had learned how to use a telescope on the school dome project, I photographed the solar eclipse of December 13, 1974, and then programmed an HP-65 to compute solar eclipses. I used my own observations and published reports to check my calculations. Then came a total lunar eclipse in May, 1975, along with a Celestron 8 for my birthday. I then went to work on computation of lunar eclipses. These computations were the basis of exhibits in the Regional Science Fairs in 1975 and 1976. Fortunately, I did well each year.

I became acquainted with microcomputers last summer when I assembled an SWTP 6800 and learned to program it. Then I had the opportunity to assemble an IMSAI with disc to build a system for a civil engineering firm which will be used for surveying and accounting. Converting my solar eclipse computations to the microcomputer was one way of debugging the system. I also wanted to prove to myself that the IMSAI could handle the highly scientific calculations in a relatively short time.

The equipment used in this system consists of an IMSAI 8080 40K, MITS 4.0 Disc Extended BASIC, ADM-3 CRT, and Diablo Hyterm printer.

My program, "Prediction of Solar Eclipses by Microcomputer" is based on the formulas and Besselian elements contained in the *Canon of Solar Eclipses* by Jean Meeus. I have data for use in the program for eclipses from 1850 to 2525. This is not an eclipse search program. It handles only one eclipse at a time. It was designed to plot the curve of a predicted solar eclipse and could be used to find the best viewing location for the scientist or photographer. The sample program is of an eclipse that occurs at my hometown, Dallas, Texas, on June 30, 2345.

The program is over 12K long and takes 40K to run using the Disc Extended BASIC. It could be modified for use in a smaller BASIC.

Input for the program consists of the latitude, longitude, and elevation of the location of a specific point wanted. The data consists of nine elements which denote the location of the sun, moon, and earth at a certain time. The calculations were done from five to seven times for each hour of the eclipse, and the number of times is denoted by C4. I use a small interpolation program, Statements 16450-16750, to break down time elements for plotting.

First thing the computer does is determine if the eclipse is partial or total in the location requested. Statement No. 9700 makes this determination. After determining whether the eclipse at the specific location is partial or total or not at all, then the program branches off to the indicated calculation.

As the program progresses, output is printed periodically. The first is the listing of the variable data in Statements 26550-27500. The purpose of the first page is to check for data typographical errors. The second page contains auxiliary data which are additional elements derived from calculation.

Page 3 is the curve of the central line for every 12 minutes of time used for a small scale plot of the entire eclipse using only 10 to 12 points.

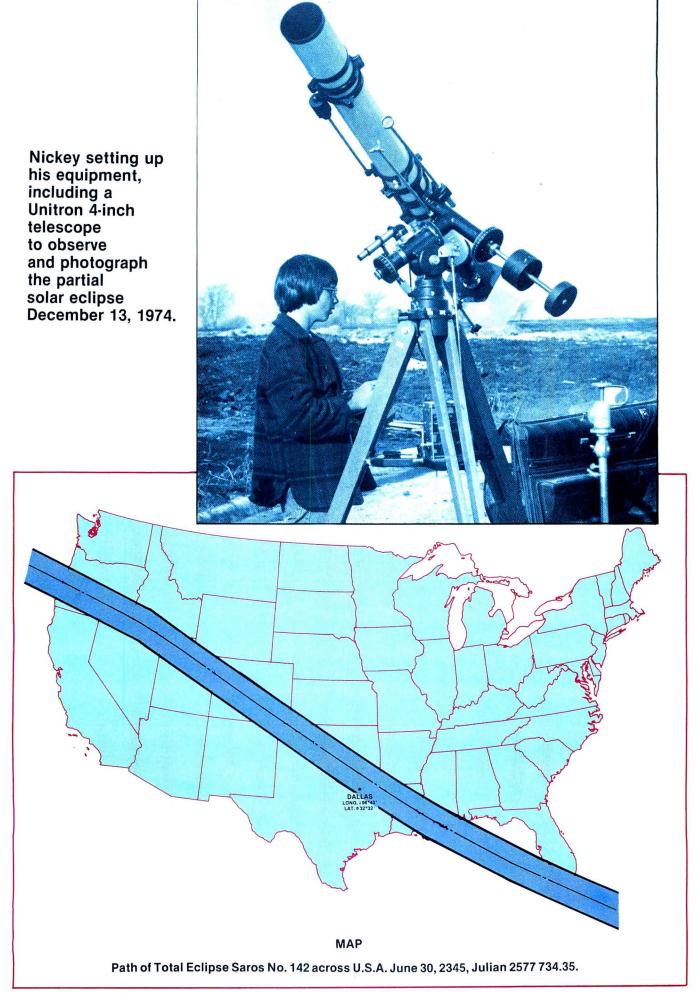
Page 4 contains information for plotting the curve for the central line of the eclipse by every one degree of longitude. For precise plotting, other information includes the latitude in degrees and decimal, sun's altitude from the horizon, duration of the totality on the central line, and the width of the path in kilometers.

The last page gives information pertaining to the eclipse in the area requested. If the eclipse in the location is total, then it gives the magnitude of the totality, which is the percentage of the sun that is covered; a total is 1.00 or more. It also gives the beginning, maximum, and end times of the eclipse expressed in Universal Time. The last statement is the duration of totality in that area. The partial eclipse calculations give the magnitude, start, maximum and end times, also.

Any readers who want additional information on any part of this program, please direct inquiries to me in care of INTERFACE AGE.

38 INTERFACE AGE AUGUST 1977

<sup>© 1977</sup> Nickey Naumovich, Jr.



| INPUT                      |  |
|----------------------------|--|
| Statement No<br>1500-2100: | The Besselian elements and string constants are stored in data form. The data is constant for the particular eclipse with which the reader is working — in this example the eclipse of June 30, 2345. In this space ,variables for other eclipses can be inserted. |
| 2300-3150:                 | This section reads data into variables.  |
| 3200-3450:                 | Input sample   |
| 3500-3750:                 | Specific location to be plotted. Input location name, longitude, latitude, and elevation. (No comma between city and state)  |
| PROCESSING                 |  |
| 3850-4250:                 | Conversion of latitude and longitude.  |
| 4500-5550:                 | Compute geocentric coordinates of observer location.   |
| 5750-6000:                 | Routine to convert degree decimal to degree minutes and seconds.   |
| 6200-6300:                 | Routine to convert degree minutes and seconds to degree decimal.   |
| 6350:                      | Branch to 16050  |
| 16050-16250:               | Table for interpolation.   |
| 16450-16750:               | Interpolation routine, which is the heart of the program and is used more than any other routine.  |
| 16950-17400:               | Auxiliary table. These are formulas to compute auxiliary quantities using Besselian elements. These are additional to the Besselian elements for processing.   |
| 17600-21100:               | This sets up a table of points to be used for interpolation to derive a number of other points later in the program.   |
| 21350-23350:               | Calculation of longitude and latitude coordinates for plotting curve of central eclipse. Data is set up for  |

| 6550-9700:   | Through interpolation, it will be determined whether the eclipse is total or partial at the observer's location. |  |
|--------------|--|--|
| 9900-10600:  | Calculation of total eclipse.  |  |
| 13000-13800: | Calculation of partial eclipse.  |  |
| OUTPUT       |  |  |
| 26550-27500: | Listing of Besselian elements in column form to check data for typogrpahical errors. Refer to Page 1.            |  |
| 27700-28450: | Listing of auxiliary quantities for program proofing. Refer to Page 2.   |  |
| 25050-26350: | Print curve details of central eclipse for every 12 minutes for fast full eclipse plotting. Refer to page 3.     |  |
| 23550-24850: | Print plot data for every one degree of longitude for high detail plotting. Refer to Page 4.                     |  |
| 10800-12800: | If eclipse is total, then print circumstances of total eclipse at observer's location. Refer to Page 5.          |  |
| 14000-15850: | If eclipse is partial, then print circumstances of partial eclipse at observer's location. Refer to Page 5.      |  |
| 28650-29150: | Print routine for solar and partial eclipse heading.<br>Refer to Page 5.   |  |
|              |  |  |

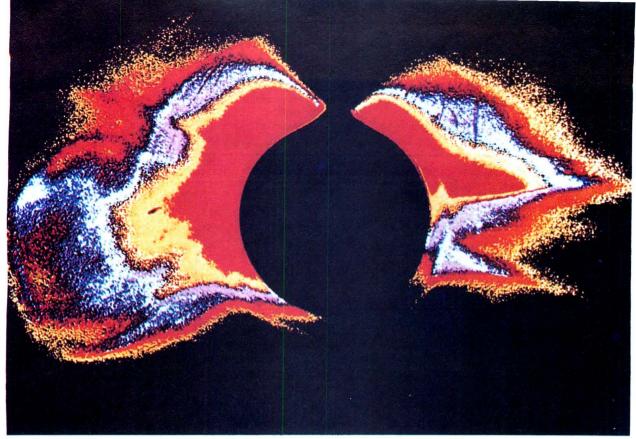
### NOTES:

- (1) Between reports 2 and 3 the computer is interpolating for details of reports 3, 4, and 5. There is a delay of approximately seven minutes while the computer calculates.
- (2) The program was written in simple BASIC language and can be revised for many smaller BASIC programs.
- (3) The listing program is 18,165 bytes. With the remarks deleted the program is 12,763 bytes. When the program is run the total storage is 19,179 bytes with data of 6,416 bytes. The program storage can be reduced by deleting print formats MITS Extended Disc BASIC is 20,858 bytes.

| IAN | DATE 2577734 | .35     | 2345 JU   | NE 30      | SAROS   | COPYRIGE<br>NO.142 |         | NICKEY NAUMO<br>AS, TEXAS - |     | R  |     |
|-----|--------------|---------|-----------|------------|---------|--------------------|---------|-----------------------------|-----|----|-----|
|     |              |         | BES       | SELIAN     | ELEME   | NTS                |         |                             |     |    |     |
| Λ1  | A2           | A 3     | A 4       | A5         | A 6     | Α7                 | A.8     | A 9                         | B 1 |    |     |
| 18  | -1.34499     | 0.55486 | 0.0096055 | -0.0015937 | 0.39226 | 0.91985            | 0.53014 | -0.01590                    | 88  | 52 | 50. |
| 19  | -0.76863     | 0.45905 | 0.0096064 | -0.0016001 | 0.39222 | 0.91987            | 0.53019 | -0.01586                    | 103 | 52 | 48. |
| 20  | -0.19225     | 0.36285 | 0.0096063 | -0.0016064 | 0.39218 | 0.91989            | 0.53021 | -0.01584                    | 118 | 52 | 46  |
| 21  | 0.38411      | 0.26628 | 0.0096052 | -0.0016125 | 0.39214 | 0.91991            | 0.53020 | -0.01585                    | 133 | 52 | 44  |
| 22  | 0.96036      | 0.16935 | 0.0096031 | -0.0016184 | 0.39210 | 0.91992            | 0.53017 | -0.01588                    | 148 | 52 | 42  |
| 23  | 1.53646      | 0.07208 | 0.0096000 | -0.0016241 | 0.39206 | 0.91994            | 0.53011 | -0.01594                    | 163 | 52 | 40  |

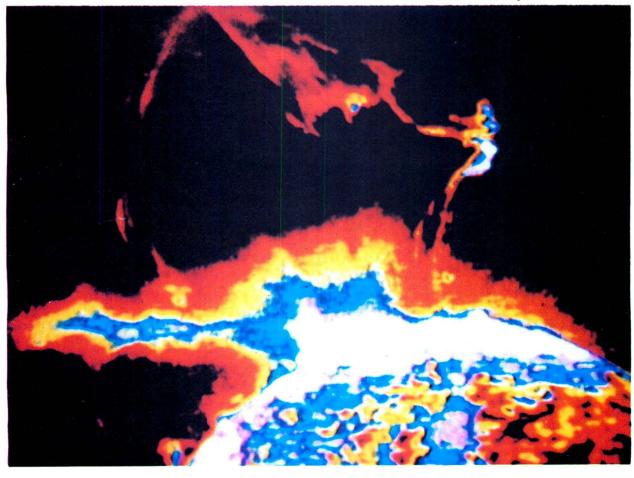
|          |               | PREDICTION  | SOLAR ECLIPSES  | BY MICROCOMPUTER        | P /         | 4 G E N O. 2                        |
|----------|---------------|-------------|-----------------|-------------------------|-------------|-------------------------------------|
| JLIAN DA | TE 2577734.35 | 2345 JUNE 3 | 0               | COPYRIG<br>SAROS NO.142 |             | CKEY NAUMOVICH, JR<br>TEXAS - 75238 |
|          |               | COMPUTED AU | XILIARY QUANTIT | IES USING BESSFLI       | AN ELFMENTS |                                     |
| A 1      | F2            | F3          | FЦ              | F5                      | F6          | F7                                  |
| 18       | -0.0007082    | 0.0105548   | 1.00286         | 0.55644                 | 0.39338     | 0.91937                             |
| 19       | 0.0002847     | 0.0103917   | 1.00286         | 0.46036                 | 0.39334     | 0.91939                             |
| 20       | 0.0012774     | 0.0102269   | 1.00286         | 0.36389                 | 0.39330     | 0.91941                             |
| 21       | 0.0022697     | 0.0100605   | 1.00286         | 0.26704                 | 0.39326     | 0.91943                             |
| 22       | 0.0032614     | 0.0098925   | 1.00286         | 0.16983                 | 0.39322     | 0.91944                             |
| 23       | 0.0042524     | 0.0097230   | 1.00286         | 0.07229                 | 0.39318     | 0.91946                             |

40 INTERFACE AGE AUGUST 1977



An eclipse seen from earth is an awesome event. Seen from space the same event shows details not visible through the earth's atmosphere. The sun's corona reaches outwards for millions of miles. The coronograph (above) was taken by one of Skylab Ill's eight telescopes. The sun's disc was masked, creating artificial eclipse. The heliospectrograph (below) was obtained from Skylab space station in Earth orbit.

Photos courtesy NASA



AUGUST 1977 INTERFACE AGE 41

PREDICTION SOLAR ECLIPSES BY MICROCOMPUTER

3 PAGE NO.

JULIAN DATE 2577734.35

2345 JUNE 30 SAROS NO.142

COPYRIGHT 1977 BY NICKEY NAUMOVICH, JR AROS NO.142 DALLAS, TEXAS - 75238

CURVE OF CENTRAL ECLIPSE

| EPHEMERIS<br>TIME | E.T.<br>LONG. | GEOGRAPHICAL<br>LONGITUDE (DEC) | GEC.<br>LONG.(DEG) | GEO.<br>LAT.(DEC) | GEO.<br>LAT.(DEG) | SUN'S<br>ALTITUDE | DURATION<br>OF TOTAL | WIDTH OF<br>PATH(KM) |
|-------------------|---------------|---------------------------------|--------------------|-------------------|-------------------|-------------------|----------------------|----------------------|
| 20.40             | 121.9200      | 117.9990                        | 117 59 54.70       | 42.1128           | 42 6 45.945       | 70.8              | 6.13                 | 271.93               |
| 20.60             | 116.2110      | 112.2890                        | 112 17 21.70       | 40.5954           | 40 35 43.570      | 69.9              | 6.08                 | 272.89               |
| 20.80             | 110.7340      | 106.8130                        | 106 48 45.44       | 38.6832           | 38 40 59.358      | 66.8              | 5.96                 | 273.67               |
| 21.00             | 105.3840      | 101.4630                        | 101 27 46.46       | 36.3772           | 36 22 37.938      | 62.1              | 5.77                 | 274.17               |
| 21.20             | 100.0150      | 96.0936                         | 96 5 37.09         | 33.6539           | 33 39 13.944      | 56.1              | 5.51                 | 274.19               |

PREDICTION SOLAR ECLIPSES BY MICROCOMPUTER

PAGE NO.

JULIAN DATE 2577734.35 2345 JUNE 30

SAROS NO.142

COPYRIGHT 1977 BY NICKEY NAUMOVICH, JR

DALLAS, TEXAS - 75238

DATA FOR PLOTTING E OF CENTRAL ECL

CURVE OF CENTRAL ECLIPSE

GEO. GEO. GEO. GEO. GEO. SUN'S DURATION WIDTH OF ALTITUDE OF TOTAL PATH(KM) EPHEMERIS UNIVERSAL GEO.
LONG.(DEG) LAT.(DEC) M S H M S DEG DEG MIN DEG LAT. (DEG) TIME DEG MIN DEG MIN H M S ----20 19 55.75 20 21 57.27 20 23 59.82 20 26 3.44 20 28 8.12 20 30 13.89 20 34 28.55 20 36 37.38 20 38 47.22 20 40 57.30 70.5 70.7 70.8 70.9 70.8 70.7 70.5 70.2 42 32.2172 42 19.8981 42 6.7854 41 52.8577 41 38.0933 41 22.4755 6.7854 20 4 14.75 20 6 16.27 20 8 18.82 20 10 22.44 20 12 27.13 20 14 32.89 271.56 271.74 271.93 120.0 0.0 120 42.5370 119.0 118.0 117.0 116.0 6.13 6.13 6.12 6.12 119 118 117 42.3316 42.1131 0.0 272.10 272.28 41.6349 116 0.0 115.0 114.0 113.0 0.0 6.11 20 14 32.89 20 16 39.69 20 18 47.55 20 20 56.38 20 23 6.22 20 25 16.95 20 27 28.53 20 29 40.90 20 31 54.00 41.0998 5.9866 48.6147 6.10 272.61 272.78 114 0.0 41 40 0.0 113 69.8 69.4 68.9 68.3 67.0 272.93 112.0 40.5058 40 30.3479 6.08 40.1863 39.8516 111.0 111 0.0 40 11,1784 6.06 51.0986 110.0 39 6.04 273.23 110 0.0 39.5018 39.1366 38.7561 273.38 273.51 273.64 109.0 109 39 30.1048 6.02 8.1942 45.3680 21.6286 56.9801 5.99 108.0 39 108 0.0 38.7561 38.3605 37.9497 37.5238 37.0831 36.6278 36.1579 35.6740 35.1761 34.6647 66.2 65.4 64.5 63.6 61.6 60.5 59.4 20 34 7.70 20 36 21.91 20 38 36.52 20 40 51.41 20 43 6.46 20 45 21.53 49 48.70 52 2.90 54 17.52 106.0 106 0.0 38 5.94 273.76 273.87 20 5.87 5.83 5.79 5.75 20 104.0 104 0.0 31.4303 273.97 56 32.41 58 47.46 1 2.53 3 17.43 5 32.07 7 46.21 4.9880 37.6657 20 103.0 103 0.0 274.06 274.14 274.19 101.0 101 0.0 36 9.4766 20 47 36.43 20 49 51.07 20 52 5.21 5.70 100.0 35 35 34 100 0.0 10.5668 99.0 99 274.26 58.3 57.2 274.26 0.0 5.61 274.23 9 59.73 12 12.38 14 24.03 20 54 18.73 20 56 31.38 20 58 43.03 97.0 97 34.1403 33.6030 34 8.4151 0.0 56.0 54.8 53.6 52.3 51.1 96.0 96 0.0 33 36.1826 3.2160 5.50 33.6030 33.0536 32.4924 31.9200 31.3370 274.11 95 5.45 0.0 16 34.41 18 43.30 20 50.55 21 21 21 5.39 0 53.41 94.0 94 29.5434 274.00 2.30 9.55 93.0 92.0 93 31 55.1990 20.2180 273.85 0.0 0.0 5.27 273.67 31 21 7 14.79 21 7 14.79 21 9 17.76 21 11 18.39 21 13 16.60 21 15 11.35 21 17 2.48 22 55.79 24 58.75 26 59.38 28 57.60 30 52.35 32 43.48 91.0 91 30.7439 30 44.6310 49.8 5.21 273.45 48.6 273.18 272.87 30.1414 29.5303 28.9113 28.2850 90.0 90 0.0 30 8.4851 31.8164 5.15 29 88.0 87.0 0.0 28 54.6790 17.1002 46.1 272.51 272.09 88 5.02 87 4.96 86.0 86 0.0 27.6521 27.0140 27 27 39.1260 43.7 4.89 271.62 271.08 21 17 2.48 21 18 50.91 21 20 35.17 21 22 14.93 21 23 50.29 21 25 20.16 34 31.91 36 16.17 37 55.93 85.0 26.3713 25.7245 25.0751 24.4238 84.0 83.0 0.0 26 25 22.2766 41.4 4.76 270.48 269.81 84 39 31.29 41 1.16 82.0 81.0 0.0 25 4.5081 25.4297 39.2 4.62 269.06 268.23 21 82 21 42 26.63 21 26 45.63 80.0 0.0 23.7720 46.3184 4.49 267.33

42 INTERFACE AGE AUGUST 1977 JULIAN DATE 2577734.35

2345 JUNE 30

SAROS NO.142

COPYRIGHT 1977 BY NICKEY NAUMOVICH, JR 142 DALLAS, TEXAS - 75238

THIS IS A TOTAL ECLIPSE AT YOUR LOCATION OF DALLAS TEXAS

LONGITUDE 96 DEG. 43 MIN. 0.00 SECONDS LATITUDE 32 DEG. 52 MIN. 0.00 SECONDS ELEVATION 614.0 FEET

IN THE YEAR OF 2345 JUNE 30

TIME OF MAXIMUM TOTAL ECLIPSE 20 HRS 57 MINUTES 12.2868 SECONDS - UNIVERSAL TIME (UT).

MAGNITUDE OF MAXIMUM ECLIPSE 1.01601

BEGINNING OF TOTAL ECLIPSE 20 HRS. 55 MIN. 17.2737 SECONDS (U.T.)

MAXIMUM OF TOTAL ECLIPSE 20 HRS. 57 MIM. 12.2868 SECONDS (U.T.)

END OF THE TOTAL ECLIPSE 20 HRS. 59 MIN. 7.3000SECONDS (U.T.)

DURATION OF TOTALITY 3 MINUTES 50.0262 SECONDS (U.T.) AT DALLAS TEXAS

```
LISTING
| 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 1000 | 
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               5400 C7=AM
5450 AN=AI*COS(AE)
5500 C8=AN
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              TO CONVERT DEGREE DECIMAL TO DEG,MIN,SEC
  DATA - BESSELIAN ELEMENTS AND STRINGS CONSTANTS STORED
                    DATA - BESSELIAN ELEMENTS AND STRINGS CONSTANTS STORED

DATA20.4,21.4,2,120,80,-1

DATA20.40,21.4,21,20,80,-1

DATA2.304600,.004577,14,9994,6,941

DATA2345 JUNE 30,5860S NO.142,JULIAN DATE 2577734.35

DATA18,19,20,21,22,23

DATA-134499,-76863,-19225,.38411,.96036,1.53646

DATA.15486,.45905,.36285,.26628,.16935,.07208

DATA.005055,.096604,.J096063,.0096052,.0096031,.0096000

DATA.005055,.0096064,.J096064,-0016125,.0016124,-.0016241

DATA.3926.39222,.39218,.39210,.39206

DATA.91985,.91987,.91989,.91991,.91992,.91994

DATA.55194,.53019,.53021,.53017,.53011

DATA-01590,..01586,..01584,..01585,..01588,..01594

DATA8.55250,103.5248,118.5246,133.5244,148.5242,163.5240
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               0500 L=PP:AK=PM

0600 7=C4:H4=L

0600 FOR X=1 TO (4:N1(X)=A1(X):N2(X)=A2(X):NEXT X

7700 GOSUB 10450

0750 A2:NP

6800 7=C4:H4=L

0500 7=C4:H4=L
                         READ VALUES INTO BESSELIAN ELEMENTS AND STRING VARIABLES
                     READ VALUES INTO BESSELIAN ELEM

READ C1.C2,C3,C4,C6

READ C1.C2,C3,C4,C6

READ C1.S,C28,C48

FOR X = 1 TO C4:READ A1(X):HEXT X
FOR X = 1 TO C4:READ A2(X):NEXT X
FOR X = 1 TO C4:READ A3(X):NEXT X
FOR X = 1 TO C4:READ A3(X):NEXT X
FOR X = 1 TO C4:READ A6(X):NEXT X
FOR X = 1 TO C4:READ B1(X):NEXT X
FOR X = 1 FO C4:READ B1(X):NEXT X
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               FOR X=1 TO CH:N1(X)=A1(X):N2(X)=B2(X):NEXT X
GCSUB 16450
KS-MF
Z=CH:NB=L
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   7050 FOR X= 1 TO C4:N1(X)=A1(X):N2(X)=A9(X):NEXT X 7100 GOSUB 16451
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 7100 GOSUB 14457
7150 KC=NB
7200 Z=C4:N#=L
7250 FOR X=1 TO C4:N1(X)=A1(X):N2(X)=A7(X):NEXT X
7300 GOSUB 16450
7400 Z=C4:N#=L
7450 FOR X=1 TO C4:N1(X)=A1(X):N2(X)=A6(X):NFXT X
7500 GOSUB 16450
7550 KG=NB
7600 Z=C4:N#=L
7650 FOR X=1 TO C4:N1(X)=A1(X):N2(X)=A3(X):NFXT X
7650 FOR X=1 TO C4:N1(X)=A1(X):N2(X)=A3(X):NFXT X
                        B2(X)=D9:B3(X)=D3:B4(X)=D6:B5(X)=D8
NEXT X
000 Hetal (1000 NEXT X 1000 CE=C6/3600 | 1500 CE=C6/3600 | 1500 CE=C6/3600 | 1500 CE=C6/3600 | 1600 CE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     7650 FOR X= 1 TO C4:N1(X)=A1(X):N2(X)=A3(X):NFXT X
7700 GOSUB 16450
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 7650 FOR X = 1 TO C4:N1(X)=A1(X):N2(X)=A3(X):NFXT X
7700 GOSUB 16450
7850 Z=C4:H4=L
7850 FOR X=1 TO C4:N1(X)=A1(X):H2(X)=A4(X):NFXT X
7900 GOSUB 16450
7950 LA=N8
6000 Z=C4:H4=L
8650 FOR X = 1 TO C4:N1(X)=A1(X):N2(X)=A5(X):NEXT X
8100 GOSUB 16450
8150 L8=N8
8200 Z=C4:H4=L
8550 FOR X = 1 TO C4:N1(X)=A1(X):N2(X)=A8(X):NEXT X
8300 GOSUB 16450
8250 FOR X=1 TO C4:N1(X)=A1(X):N2(X)=A8(X):NEXT X
8300 GOSUB 16450
8400 LB=C1.00Z74*C6)*(C3/3600)
8450 LC=KR-C9=LR
8500 LD=LC/57.2958
8500 LD=LC/57.2958
8500 LG=C8*LE
8600 LF=COS(LD)
8650 LG=C8*LE
                      "___INPUT "LOCATION-CITY"; C3s
INPUT "LONGITUDE"; C9
INPUT "LATITUDE"; CA
INPUT "ELEVATION"; CB
INPUT "METERS(1) FEET(2)"; CC
PRINT CHR$(12)
3650
                        CONVERT LONGITUDE (D.MS) TO (DEGREES), (DEGREES, MINUTES, SECONDS)
D1=C9:GOSUB 6200
                        DS=D9: DT=D2: DU=D6: DV=D8
                           8650 LG=C8*LF

8700 TB=C8*LF

8700 TC=C7*KE-C8*LF*KG

8800 TD=C7*KG-C8*LF*KG

8800 TF=C(3*C5)*C8*LF

8900 TF=C(3*C5)*C8*LF

9000 TF=KG

9000 TF=KG

9000 TH=AZ-TB

9000 TH=AZ-TB

9200 TL=L8-TF

9200 TL=L8-TF

9200 TL=L8-TF

9200 TL=SE-TF*C2

9300 TB=TF*TK

9400 TB=TF*TM

9400 TB=TF*TM
                     DWsP9.DXsD3.DYsD6:DZsDM

COMPUTE GEOCENTRIC COORDINATES OF OBSERVERS LOCATION

FELFVALION OF ORSERVERS LOCATION AROVE SEA LEVEL IN FEET OR METERS

ON CC GOTO #550, #700
AC 1, 56779E.-07*CR
HF8:= "METERS"
GOTO 5100
AC 4.77865E--08*CR
HF8:= "FEET"

NUMBERICAL FACTORS (AF) AND (AC), GEOGRAPHICAL LATITUDE (DW)
AND UNITS OF THE EQUATORIAL RADIUS OF THE ERBTH (AC)
WILL COMPUTE GEOCENTRIC COORDINATES OF ORSERVERS
LOCATION (C7) AND (C8)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     9450 TR=TF*TK-TJ*TI
9500 TT=TH*TJ+TI*TK
9550 TU=TS/TR
9500 TX=TU
                         AE=DW757.2958
AF=.094953-1.6778E-03*COS(2*AE)+2.1E-06*COS(4*AE)
AG=1.00106-1.6802E-03*COS(2*AE)+2.1E-06*COS(4*AE)
AH=AE+AC
```

## COMPUTER CONTROLL **PLOTTERS**



### ASSEMBLED

11 x 17 inch size (Delivery stock) 17 x 22 inch size (Delivery 3-8 weeks)\_ Owner's Manual (refunded with plotter purchase)\_\_\_

- We supply plotter and interface -

- You supply computer and software -
- Dealer inquiries invited -

### WRITE TODAY!

Sylvanhills Cahoratory, Inc.

#1 Sylvanway, Box 239 Strafford, Mo. 65757

417-736-2664

**CIRCLE INQUIRY NO. 53** 



**CIRCLE INQUIRY NO. 44** 

```
10050 RN=((TM*TY)/TP)/60
10100 RP=TT/TN/60
 10100 RP=TT/TM/60

10150 RR=RN-RP/60

10200 RX=R7+RR

10250 RY=R8+RR

10300 ST=ABS(TT/TF)

10350 SM=(TL-ST)/(TL+TM)

10400 XX=AR+AMS(RP)-APS(RN)

10450 YY=AK+ABS(RP)+ABS(RN)

10500 WM=AK+ABS(RP)

10500 ZZ=YY-XX
    10600 GOSUB 25050
10650 '-----
10700 '
                                                                                                                                PRINT ROUTINE TOTAL SOLAR ECLIPSE PAGE 5
     10800 GOSUB 28650
10850 XX=XX-CE
 11250 ZT$="MAXIMUM OF TOTAL ECLIPSE 00 HRS. 00 MIM. 00.000 SECONDS (U.T.)"
11300 ZV$="END OF THE TOTAL ECLIPSE 00 HRS. 00 MIN. 00.0000 SECONDS (U.T.)"
11350 ZV$="DURATION OF TOTALITY 00 MINUTES 00.0000 SECONDS (U.T.)"
11400 PRIMT: PR
      11450 PRINT TAB(30); "THIS IS A TOTAL ECLIPSE AT YOUR LOCATION OF ";C3*
 11500 PRINT:PRINT
11500 PRINT:PRINT
11500 PRINT TAR(40);
11600 PRINT USING ZMS;DT,DU,DV:PRINT
11600 PRINT USING ZMS;DT,DU,DV:PRINT
11600 PRINT USING ZMS;DX,DY,DZ:PRINT
11700 PRINT USING ZMS;DX,DY,DZ:PRINT
11700 PRINT USING ZPS;CB::PRINT HFS:PRINT:PRINT
11800 PRINT USING ZPS;CB::PRINT HFS:PRINT:PRINT
11800 PRINT USING ZPS;CB::PRINT HFS:PRINT:PRINT
11900 DRINT USING ZPS;CB::PRINT HFS:PRINT:PRINT
11900 DR:MX:GOSUB 5750
12000 PRINT USING ZRS;DL,DM,DN:PRINT:PRINT
12100 DR:MX:GOSUB 5750
12200 PRINT USING ZSS;DL,DM,DN:PRINT:PRINT
12250 DR:MX:GOSUB 5750
12200 PRINT USING ZSS;DL,DM,DN:PRINT:PRINT
12250 DR:MX:GOSUB 5750
12300 PRINT USING ZSS;DL,DM,DN:PRINT:PRINT
12250 DR:MX:GOSUB 5750
    12300 PRINT T4B(26);
12350 PRINT USING 7T$; DL, DM, DN: PRINT: PRINT
12400 DK=YY: GOSUB 5750
    12450 PRINT TAB(26);
12500 PRINT USING ZU$;DL,DM,DN:PRINT:PRINT
12550 DK=7Z:GOSUB 5750
     12500 PRINT TAB(23);
12600 PRINT USING ZV$;DM,DN;:PRINT C3$:PRINT:PRINT
12700 PRINT:PRINT:PRINT:
                                                                                                                                                       PARTIAL ECLIPSE CALCULATIONS
  13050 SS=TS/SR

13100 R=ATM(SS/SOR(-SS*SS+1))*57.2958

13150 TY=COS(R/57.2958)

13200 RM=TL*TY

13200 RM=((TL*TY)/TP)/60

13300 RP=TT/TN/60

13400 RX=RH-RRP/60

13400 RX=RF*HR

1350 RR=KR+RR

1350 XX=AK+ABS(RP)-ABS(RN)

13500 YX=AK+ABS(RP)+BS(RN)

13600 WM=AK+ABS(KP)
    13650 XZ=YY-XX
13700 ST=ABS(TT/TP)
13750 SM=(TL-ST)/(TL+TM)
13800 GOSUB 25050
                                                                                                                          PRINT ROUTINE
                                                                                                                                                                                                                    PARTIAL SOLAR ECLIPSE
 14300 YT$="MAXIMUM OF THE PARTIAL ECLIPSE ## HRS. ## MIM. ##.#### SECONDS (U.
    T)"
14350 YUS="END OF THE PARTIAL ECLIPSE ## HRS. ## MIN. ##.#### SECONDS (U.T.)"
14400 YVS="DURATION OF THE PARTIAL ECLIPSE ## HRS. ## MIN. ##.#### SECONDS (U.T.)"
.T.)"
TATAL THE PRINT: PRINT: PRINT 14900 PRINT: PRINT: PRINT 14900 PRINT: PRINT 14900 PRINT: PRINT 14900 PRINT: PRINT 14900 PRINT: PRINT 14900; 14000 PRINT: PRINT 1400; 14000 PRINT: PRINT 1400; 14000 PRINT: PRINT 1400; 14000; 14000 PRINT: PRINT:
     10036 | PATA P.1.003378,3,1.003369,6,1.003341 | 16100 PATA P.1.003295,12,1.00322,15,1.003151 | 16150 PATA 18,1.003054,21,1.002442,24,1.002617 | 16200 79,9508 | 1 TO 7:READ N1(I),N2(I):NEXT I
```

```
16750 NR=NR+N7*N2(J)
16750 NEXT J
16750 RETURN
16800 '----
   16750 RETURN
16800 .

16850 .

16850 .

16850 .

16900 .

16900 .

16950 FOR X= 1 TC C4

17000 P2(X)=-(45(X))+A2(X)*A6(X)*C3*C5

17000 P3(X)=-(45(X))+A2(X)*A6(X)+A9(X)*C2*A7(X))*(C3*C5)

17100 R=4TN((A6(X))*SQR(-A6(X)*A6(X)+1))*57.2958

17200 P4(X)=H4(X)*A6(X)

17200 P4(X)=H4(X)*A6(X)

17300 P7(X)=-996633*(F4(X)*A7(X))

17350 NEXT X

17400 GOSUB 26550

17450 .

START PLOT PREDICTIONS CALCULATI
                                                                              START PLOT PREDICTIONS CALCULATION
         17650 FOR L=R7 TO R8 STEP R9
17700 BS=R5-1
17750 Z= C4:N4=L
17800 FOR X= 1 TO C4:N1(X)=A1(X):N2(X)=A2(X):NEXT X
17850 GOSUB 16450
17950 FOR X= 1 TO C4:N1(X)=A1(X):N2(X)=F5(X):NEXT X
12000 GOSUB 16450
18500 K2=R8
18150 FOR X=1 TO C4:N1(X)=A1(X):N2(X)=F6(X):NEXT X
18150 GOSUB 16450
18700 GOSUB 16450
18700 FOR X=1 TO C4:N1(X)=X(X):N2(X)=F7(X):NEXT X
18150 GOSUB 16450
18700 FOR X=1 TO C4:N1(X)=X(X):N2(X)=F7(X):NEXT X
18400 GOSUB 16450
18700 FOR X=1 TO C4:N1(X)=X(X):N2(X)=F7(X):NEXT X
18400 GOSUB 16450
      18:40 KWENS
18:40 FOR V: 1 TO CU:N1(X):A1(X):N2(X):B2(X):NEXT X
18:450 GOSUB 18:450
18:450 MI:N8
      18500 M1=N8
18560 POR X: 1 TO C4:N1(X)=A1(X):N2(X)=F2(X):NEXT X
18600 GOSUB 14850
18650 M2=N2
18750 POR X: 1 TO C4:N1(X)=A1(X):N2(X)=F3(X):NEXT X
18750 GOSUB 16450
18760 GOSUB 16450
18760 M3-18
18760 M3-18
18950 K8=K2*K4*K5*K3
19903 BEATN(K87/CK(-K6*K6+1))*57.2956
1930 K9=TAN(K7/CK(-K6*K6+1))*57.2956
1930 K9=TAN(K7/C,2958)*1,003*6
1930 K9=TAN(K7/C,2958)*1,003*6
19300 K9=ATN(K9)
19200 K9=ATN(K9)
1
   1945; XB: 48; W* 4M1-M6
1960; WB: 47-4; 167F-03*06
19650; *=C4: N4=L
19706 FOR X= 1 TO C4: N1(X)=A1(X): N2(X)=A9(X): NEXT X
14*50 GOSUB 16450
18500 FOE X=1 TO C4: N1(X)=A1(X): N1(X)=A7(X): NEXT X
19906 FOE X=1 TO C4: N1(X)=A1(X): N1(X)=A7(X): NEXT X
19906 FOE X=1 TO C4: N1(X)=A1(X): N1(X)=A7(X): NEXT X
19950 GOSUB 16450
2006 Ma: 49*72+M2*72
2007 Ma: 40*72+M2*72
2007 M3: 40*72+M2*72
20
20050 Marm9*2+M2*2

20100 MB-SCR(MA):KF:120*KD/ME

20100 Zefa,Nd=L

20200 FCB X:1 TO CH:N1(X):A1(X):N2(X):A6(X):MEXT X

20200 RCB T:0450

20300 RCB T:0450

20400 RB:M5/77.2956:KH:SIN(R3):KI:COS(R1)

20400 RB:M6/57.2956:KH:SIN(R3):KI:COS(R1)

20400 RB:M6/57.2956:KH:SIN(R3):KI:COS(R1)

20400 RB:M6/57.2956:KH:SIN(R3):KI:COS(R1)

20400 RB:M6/57.2956:KH:SIN(R3):KI:COS(R1)

20500 RZ:ATN(LI/SQR(-LI*LI+1))*57.2958

20500 RZ:ATN(LI/SQR(-LI*LI+1))*57.2958
         20500 K2=RFLL(FYSR(-LIFL(FT))*57.2996
20505 FOR X=1 TO C4:N1(X)=A1(X):N2(X)=A3(X):NEXT X
20700 GCRUB 16456
20700 L3-M*:MC=C1*M*9-L3*M2
20800 MD=M*-MC*2/MA
20800 L4=SOR(MD):L5=2*KFZL4
20800 L6=SOR(MD):L5=2*KFZL4
20900 L6=L5**0375
20900 KF=ABS(KF):L6=ABS(L6)
21000 P1(B$)=LF2(R5)=M7:F*(R5)=MF:P4(R5)=M5:P5(R5)=L8:P6(R5)=KF:P7(R5)=L6
21000 P1(B$)=LF2(R5)=M7:F*(R5)=MF:P4(R5)=M5:P5(R5)=L8:P6(R5)=KF:P7(R5)=L6
21100 R6=R5
21100 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **
21200 **

         21300 Vario
21400 PSP X:1 TO R5:H1(X)=P3(X):N2(X)=P1(X):NEXT X
21400 PSP X:1 TO R5:H1(X)=P3(X):N2(X)=P1(X):NEXT X
21500 Z=R5:Na=P5:Va=Va=1
21400 OSUP 16450
21600 VG(Va)=N5
21600 VG(Va)=N5
21600 VG(Va)=N5
21600 PSP X:1 TO R5:N1(X):P3(X):N2(X)=P4(X):NEXTX
21600 PSP X:1 TO R5:N1(X):P3(X):N2(X)=P5(X):NEXTX
21600 PSP X:1 TO R5:N1(X):P3(X):N2(X)=P5(X):NEXT X
21600 PSP R5:N1(X):N2(X)=P3(X):NEXT X
21600 PSP R5:N1(X):N2(X)=P3(X):NEXT X
21600 PSP R5:N1(X):N2(X)=P5(X):NEXT X
21600 PSP R5:N1(X):N2(X)=P5(X):N2(X)=P5(X):NEXT X
21600 PSP R5:N1(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2(X)=P5(X):N2
                      #50 UDDUB 1649
                      2.95 MEXT PS
2/CDC VA:0
2/CDC VA:0
2/CDC POP X:1 TO PS:NI(X)+P3(X):N2(X)+P7(X):NFXT X
2/CDC POP POPYT TO Y2 STEP V3
```



**CIRCLE INQUIRY NO. 37** 

### ASSEMBLER/EDITOR

### ADDITION TO SOFTWARE PACKAGE 1 SYSTEM 8080 OR Z-80

NOW YOU CAN HAVE AUTOMATIC INSERTION OF LINE NUMBERS DURING PROGRAM ENTRY AND EDITING, AN EXTENSIBLE COMMAND TABLE. REORDERING OF LINE NUMBERS, AN ASC PSEUDO OP FOR PLACING ASCII MESSAGES IN PROGRAM, A GLOBAL SYMBOL TABLE. OCTAL NUMBERS RECOGNIZED BY THE ASSEMBLER, AN EXTENSIBLE LIST OF PSEUDO OPS. AN EFFICIENT TAPE DRIVER FOR TARBELL. DAJEN. AND OTHER INTERFACES, AND MORE. DO MULTIPLE SECTION ASSEMBLIES BY BUILDING PROGRAM SOURCE CODE ON SEVERAL TAPE FILES AND READING IN FILES IN SEQUENCE. SYSTEM IS PROMMABLE WITH 6K IN HIGH MEMORY.

### **SOFTWARE PACKAGE 0.5**

SOURCE

OBJ. CODE-PAPER TAPE OBJ. CODE-TARBELL

\$14.95

\$19.95

\$24.95

IMMEDIATE DELIVERY

OBJECTIVE DESIGN, INC. P.O. BOX 20325 TALLAHASSEE, FL 32304

(904) 224-5545

FLORIDA RESIDENTS ADD 4% STATE SALES TAX

**CIRCLE INQUIRY NO. 39** 

## THE LATEST IN TAPE SYSTEMS





### 4800 BAUD CASSETTE RECORDER

An ASYNCHRONOUS NRZ type Recorder with remote motor start/stop. Error rate 10<sup>8</sup> at 4800 BAUD. Can be used from 110 to 4800 BAUD into a UART or "Bit Danger PIA" — no clocking required. This is not an audio recorder. It takes RS232 or TTL signals from the terminal or computer and gives back the same signals. No audio interface is used. Motor start/stop is manual or through TTL or RS232 signals.

Tape speed is 3.2"/second nominal; 1.6"/sec. optional. 110 volt, 60 Hz, 5 watts. (220 Volts on special order). Can use high quality audio cassettes (Philips Type) or certified data cassettes. Can be used in remote locations from a 12 Volt battery.

Recommended for DATA LOGGING, WORD PROCESSING, COMPUTER PROGRAM RELOADING and DATA STORAGE. Especially recommended for 6800 systems, 6502 systems, 1800 systems and beginners with the 8080 systems. Manual control except for motor start/stop. 6800 or 8080 software for file or record searching available on request with order. Used by major computer manufacturers, Bell Telephone and U.S. Government for program reloading and field servicing.

AVAILABILITY — Off the shelf.



### 2SIO(R) CONTROLLER \$190.00 (\$160.00 Kit)

## PROVIDES MONITOR and TAPE SOFTWARE in ROM TERMINAL and TAPE PORTS on SAME BOARD CONTROLS ONE or TWO TAPE UNITS (CC-8 or 3M3A)

This is a complete 8080, 8085, or Z80 system controller. It provides the terminal I/O (RS232, 20mA, or TTL) and the data cartridge I/O, plus the motor controlling parallel I/O latches. Two kilobytes of on board ROM provide turn on and go control of your Altair or Imsai. NO MORE BOOTSTRAPPING. Loads and Dumps memory in hex on the terminal, formats tape cartridge files, has word processing and paper tape routines. Best of all, it has the search routines to locate files and records by means of six, five, and four letter strings. Just type in the file name and the recorder and software do the rest. Can be used in the BiSync (IBM), BiPhase (Phase encoded) or MRZ modes with suitable recorders and interfaces.

This is Revision 7 of this controller. This version features 2708 type EPROM's so that you can write your own software or relocate it as desired. One 2708 preprogrammed is supplied with the board. A socket it available for the second ROM allowing up to a full 2K of monitor programs.

Fits all \$100 bus computers using 8080 or Z80 MPU;s. Requires 2 MHz clock from bus. Cannot be used with audio cassettes without an interface. Cassette or cartridge inputs are RS232 level.

AVAILABILITY - Off the shelf.

### MODEL 3M3A - \$220.00

### 50 KILOBAUD CARTRIDGE RECORDER

This is a self-clocking (1/1) high speed recorder. Loads BASIC in under 2.0 seconds. Recording is done at 19.2 Kilobaud. Playback at 40 Kilobaud. File or Record searching is done at 50 Kilobaud and loading is automatic. Worst case access time about 2 minutes for up to 1.5 megabytes on the 3M Data Cartridge.

Tape speed 10"/sec. on record, up to 30"/sec. on playback. Records one clock track and one data track on each pass (2 passes). Recording is NRZ unencoded from RS232 or TTI signals.

This recorder requires one Parallel port for motor control, and one serial port for data and clock. (Cannot be used with UART's or UART boards such as the 3P+S). Used with USART's, ACIA's or other 1/1 clocking I/O devices under software control only. No manual controls. Software for 8080 and 6800 available. Power supply is built in, 110V, 60 Hz. 220V, 50 Hz for export.

AVAILABILITY - 90 Days.

OVERSEAS: Export Version 220 Volt 50 hz. Write factory or: Megatron-Datameg, 8011 Putzbrunn, Munchen, Germany; Nippon Automation 5-16-7 Shiba, Miato-Ku, Tokyo, Japan; Hobbydata, FACK, 20012, Malmo, Sweden; G. Ashbee, 172 Ifield Road, London SW 10-9ag; Trinitronics, Ltd., 186 Queen Street W., Toronto, Ontario, Canada; EBASA, Enrique Barges 17, Barcelona 14, Spain; ARIES, 7, rue Saint Philipe du Roule, 75008 Paris; Microlem 20131, Milano, Italy; Eagle Electric, Capetown, S. Africa. For U.P.S. delivery, add \$3.00. Overseas and air shipments charges collect. N.J. Residents add 5% Sales Tax. WRITE or CALL for further information. Phone Orders on Master Charge and BankAmericard accepted.

Canadian Distributor: Trinitronics Limited 186 Queen Street West Toronto, Canada M5V 1Z1 Tel: (416) 598-0262

### NATIONAL MULTIPLEX CORPORATION

3474 Rand Avenue, South Plainfield, NJ 07080, Box 288, Phone (201) 561-3600 TWX 710-997-9530

|     |      | Z=R5:                      |       |        | = V A  | + 1    |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|-----|------|----------------------------|-------|--------|--------|--------|-------|------------|---------|------------|--------|--------------|-------|----------|-------|----------|-------|-------------|------|------|-------|
|     |      | GOSUB                      |       | 50     |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | VE (VA                     |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | RETUR                      |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | ,                          |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | 'PRIN                      |       |        |        | DA:    | TA P  | LOT        | C       | URV        | E OF   | CEN          | ITR   | AL E     | CLI   | PSE      | PAGE  | 4           |      |      |       |
| 23  | 500  | '                          |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | PA=PA                      |       |        | 140.00 |        |       | Charles to |         |            |        |              |       |          |       |          |       |             |      |      |       |
| 23  | 600  | PRINT                      | TAB   | (36)   | ; Z4   | \$; T/ | AB (9 | 11);       |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | PRINT                      |       |        |        |        | HIN   | T          |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | PRINT                      |       |        |        |        | S . T | ARI        | 661     | . (2)      | · T 4  | R ( Q 1      | 1.    | 764.     | PRTI  | UΤ       |       |             |      |      |       |
| 23  | 800  | PRINT                      | TAB   | (43)   | ;ZA    | \$     | ., .  |            |         | ,          | ,      | 2,,,         |       |          |       |          |       |             |      |      |       |
| 23  | 850  | PRINT                      | TAB   | (35)   | ; H 1  | \$:F0  | )R X  | = 1        | TO      | 122        | PRI    | NT"-         | ";    | NEX      | TX    | : PRIM   | VT" " |             |      |      |       |
|     |      | PRINT                      |       | no n   |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
| 23  | 100  | PRINT<br>PRINT             | ZS\$  | : FOR  | X =    | TC     | 12    | 2:P        | RIN     | T"-        | ;:N    | EXT.         | X:    | PRIN     | T"    |          |       |             |      |      |       |
| 240 | 250  | FOR X                      | =1 1  | ro 1   | 22:1   | PRIN   | T"-   |            | NFX     | TX         | PRT    | NT           |       |          |       |          |       |             |      |      |       |
| 24  | 100  | FOR X                      | = 1 T | AV C   |        |        |       | , .        |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | VH(X)                      |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | L5=P8                      |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | L6=V8                      |       | L6=I   | NT (I  | .6):   | L8=   | V8(        | X)-     | L6:1       | .8=L   | 8*60         | 1     |          |       |          |       |             |      |      |       |
|     |      | L9=.4<br>HA\$="            |       |        | 0.0    |        |       | B B        | n n     | п          |        | и и          |       |          |       |          | 0.0   | . 0000      | 1    |      | 9.0   |
| 000 |      | HAD=                       | 00.0  | 0.0    | . " "  | 00.1   | 10 0  | # #        | 0.0     | 11 11      | # #    | 0.0          | 111   | 11.11.11 | ## 1  | 0 0 0 11 | 11.11 | . # # # #   |      | . 11 | и.    |
|     |      | DK=V9                      | (X):( | GOSU   | B 5    | 750    |       | 100        |         |            |        | 27 . 37 . 50 |       |          |       | 1 10 10  |       |             |      |      |       |
| 241 | 150  | D(1)=                      | DL:D  | (2)=   | DM:    | 0(3)   | =DN   |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | DK=VH                      |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | D(4)=1<br>VD(X)            |       |        |        | 0(6)   | =DN   |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      |                            |       |        |        | 0(1)   | D.C   | 21         | D(3     | ) D        | 4)     | 0(5)         | Di    | (6)      | P8 (1 | () 15    | 5 17  | V8(X),      | 16 1 | 8 V  | - / Y |
| ),1 | /D() | ), VE(                     | X )   |        | ,,,,   |        | ,     | -,,        | 213     | ,,0        | ,      | 0 ( ) /      | , .   |          | 100   | .,       | ,,    | · o ( a ) , | ,.   |      |       |
| 54. | 700  | NEXT                       | X     |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
| 24  | 750  | PRINT                      | : PRI | NT:F   | OR :   | X = 1  | TO    | 122        | :PR     | INT        | '-";   | : NEX        | (T)   | (:PR     | INT   | " "      |       |             |      |      |       |
|     |      | PRINT                      |       | \$ (12 | )      |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | "                          |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     | 950  |                            | INT   |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      |                            |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | HB\$="                     |       |        |        |        |       |            |         |            |        | ff.          |       | 000      | ##    | ##.1     | 1 11  | 00.000      | H.   | 0.0  | 11.11 |
| 25  | 1.00 | 7 4 5 - 11                 | 0.0   | Τ Λ    | ff F   | 0.1    | 111   | D 1        | ##.     | ##"<br>T T | T M    | C !!         |       |          |       |          |       |             |      |      |       |
| 251 | 50   | H15="                      | CIII  | RV     | F      | 0      | F     | C          | FN      | T          | 2 4    | 1            | F     | C 1      | Т 1   | 2 5 5    | . "   |             |      |      |       |
| 252 | 000  | ZA\$="<br>H1\$="<br>H4\$=" | EPHEN | MERI   | S      | E      | Т.    |            | G       | EOG        | RAPH   | ICAL         | 100   | 0 2      | GEO.  |          |       | GEO.        |      |      | GE    |
| 0.  |      |                            | ZON . | 5      | DU     | KAII   | OW    | W          | 101     | H U        |        | "            |       |          |       |          |       |             |      |      |       |
|     |      | H58="                      | TI    | ME     |        | LC     | NG.   |            |         |            |        | (DEC         | )     | LO       | NG.   | (DEG)    | L     | AT. (DE     | C)   | LAT  | . (   |
| DEC |      | ZR\$="                     | LTIT  |        |        |        |       |            |         | (KM        |        | 0            |       | C        | 0.7   |          |       | 250         |      | ,    | 200   |
| 25  | 300  |                            | UN'S  |        |        |        |       |            |         | OF         | "      | 0.           |       | U        | E.O.  |          |       | GEO.        |      |      | GEO   |
| 25  | 350  | ZS\$="                     |       |        | DOM    |        |       |            |         |            |        | EC)          | 3     | ONG      | . (DI | EG)      | LAT   | . (DEC)     | 1    | AT.  | DE    |
| G)  |      |                            | ITUD  |        | OF '   | TOT    |       |            |         |            |        |              | 0     |          |       |          |       |             |      |      |       |
|     | 100  | ZT\$="                     | H     | M S    |        |        |       | M          | S       |            | D      | EG           |       | DEG      |       | 4TN      | D     | EG          | [    | DEG  | M     |
| IN  |      |                            | DEG   |        |        | M.     | N     |            | KM      |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | PA=PA<br>PRINT             |       | 1261   |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | PRINT                      |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
| 25  | 600  | PRINT                      | TAB   | (76)   | ; 25   | \$     |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
| 25  | 550  | PRINT                      | C45   | ; TAB  | (36    | ); C   | 15; T | AB (       | 66)     | ; C2       | F;TA   | B(91         | );;   | 7.65:    | PRI   | NT       |       |             |      |      |       |
|     |      | PRINT                      |       |        | ; H 1  | \$: F  | OR X  | (=1        | TO      | 155        | PRI    | NT"-         | . " ; | : NEX    | TX    | : PRII   | NT "  |             |      |      |       |
|     |      | PRINT                      |       |        | Y -    | 1 7    | 1 12  | 20.0       | RIM     | T".        | 1 M    | FYT          | y . 1 | PRIM     | TU    | ,,       |       |             |      |      |       |
|     |      | FOR X                      |       |        |        |        | 12    |            | 11 1 19 |            | , . 14 | LAI          | ۸.    | n i N    | 1     |          |       |             |      |      |       |
|     |      | P6(X)                      |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | DK = P3                    |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | D(10)                      |       |        |        |        | (12)  | = D1       |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      | DK=P4<br>D(13)             |       |        |        |        | (15)  | = DN       |         |            |        |              |       |          |       |          |       |             |      |      |       |
| 20  | . 00 | 2(13)                      |       |        | ,-0    |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |
|     |      |                            |       |        |        |        |       |            |         |            |        |              |       |          |       |          |       |             |      |      |       |

```
26150 PRINT USING HBS;P1(X),P2(X),P3(X),D(10),D(11),D(12),P4(X),D(13),D(14),D(15),P5(X),P6(X),P7(X)

26200 PRINT:PRINT:PRINT:FOR X = 1 TO 122:PRINT"-"::NEXT X:PRINT

26300 PRINT CHR3(12)

26300 PRINT CHR3(12)

26500 GOTO 23550

26500 'PRINT ROUTINE PESSELIAN ELEMENTS PAGE 1

26500 PRINT ROUTINE PESSELIAN ELEMENTS PAGE 1

26700 PRINT ROUTINE PRINT ROUTINE PRINT PR
```

## **Business Firmware Announced!**



Includes over \$25,000.00 of business programs free and that's only part of what we're giving away. We built our reputation providing quality software at affordable prices. Now we are going to do the same with Firmware.

Dealer Inquiries Invited.

### Soon To Be Unveiled

What is a Firmware System?

A Firmware system is the entire package — Software and Hardware that work.

Our Firmware includes a miniature micro 8080 computer; S-100 Buss, with over 65K of user RAM. No switches to set, Power-on operation, multiple I/O interfaces, printer, Video Terminal, over

600K Byte Disk, Disk Extended Basic and **applications** Software on diskettes complete with full documentation (includes General Ledger, Payroll, Word Processing, Medical A/R, A/P, Engineering, Statistics, more) plus a lease purchase plan and field service in most areas. Hard to believe! For less than \$300 you could lease your very own, nothing else to purchase. Foreign packages available last of '77.

Complete System (fully assembled) ..... \$8999.00\*
Additional 600K disks optional.

Compare at \$30,000 for other micros or \$70,000 for mini's

\*Add \$60 for UPS shipping and handling • No Purchase Orders — include 50% deposit with all COD orders.



### SCIENTIFIC RESEARCH

1712-I Farmington Court Crofton, MD 21114 (301) 721-1148



## COMPUTING THE POSITIONS

By Timothy O'Shaughnessy



### INTRODUCTION

Success in observing astronomical phenomena often requires knowing when and where to look. For example, Mercury and Venus are seldom seen at midnight. These two celestial bodies are usually visible only for a couple of hours before sunrise and after sunset. Often they are eclipsed by the Sun. To avoid wasting time, the serious observer must predict the event and its location.

One additional application of the home computer is to predict astronomical phenomena. This article provides information to allow the reader to develop programs for calculating the positions of planets. Further development of the programs enables the plotting of orbits and predicting of eclipses.

### THEORY OF MOTION

To develop programs, the motion of the planets must be known. These movements are moderately complex. Although the mathematical relations appear complicated, the solution to the problems is simple. The resulting calculations, while not difficult, are numerous and thereby easily contaminated by human error, hence a computer program is a desirable approach.

The planets revolve around the Sun but do not form circular orbits, rather, the path of planets forms an ellipse (see Figure 1). The Sun does not reside at the center, rather it exists at one of the foci (Point F) of the ellipse. The planet travels faster as it approaches the Sun, in perihelion. If the shaded regions of Figure 2 represent 15 days each, then the area AFC equals the area A'FC'.

A planet completes one orbit according to the relation:

$$T = \sqrt{k(AA')^3}$$
 where  $T = \text{period}$ , which is time to complete 1 orbit 
$$AA' = \text{length of the major axis}$$
  $k = \text{constant}$ 

So according to this relation, the Earth completes orbit in 365.25 days as Mercury completes the orbit in 88 days

Other relations of the ellipse are:

$$AA' = FF' + FC + F'C$$

$$\frac{x^2}{A^2} + \frac{y^2}{B^2} = 1 \quad \text{where } A = \text{length OA}$$

$$B = \text{length OB}$$

$$e = \frac{FO}{AO}$$

$$e = \text{eccentricity}$$

$$Note: If e = O, the ellipse is a circle$$

For the moment let the ellipse be a circle (eccentricity: e = O). Then the two foci (F' and F of Figure 1) exist at the center O. The planet's distance from the Sun remains constant. In this case graphing distance as a function of phase angle results in a straight line (Figure 3-A). Since the planet's velocity depends on distance, the velocity also remains constant.

For real planets (e  $\neq$  O) the planet's distance from Sun changes. As the planet moves along the orbit, it repeatedly returns to point A (Figure 2). At point A, distance is minimum and velocity is maximum. At point A' the planet has maximum distance and minimum velocity. These functions of Figure 4 are periodic functions.

## AND OBBITS OF THE PLANETS

### SOLUTION

The conventional method of calculating the positions of the planets permits the observer temporarily to treat the orbit as circular. The observer calculates the position assuming constant angular velocity equal to the planet's average angular velocity. Later corrections are added (either from tables or graphs). Likewise, the program development of this article assumes constant angular velocity with subsequent corrections. However, the program calculates the corrections from equations which approximate the tables.

### CONVENTIONAL APPROACH

Provide the planets a numerical assignment such as:

P1 = Mercury

P4 = Mars

P2 = Venus

etc

P3 = Earth

The polar co-ordinates of the planets, often denoted as  $P = (r, \Theta)$ , are replaced with:

 $P_i = (D_i, A_i)$ 

where, D<sub>i</sub> = Distance from the Sun

to planet Pi

Ai = Angle of planet Pi with

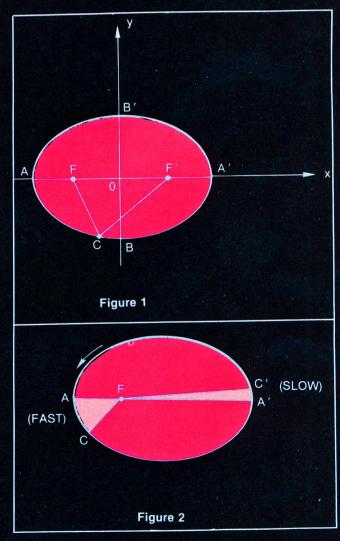
respect to Aries (Mars)

W1, W2, W3 . . . = the respective average angular velocity of P1, P2, P3 ... (see Table 1)

K1, K2, K3... = Initial angle of the planet on

December 31, 1949

N Number of Days since December 31, 1949



| PLANET  | D. | W <sub>I</sub><br>(DEG/DAY) | K <sub>(</sub><br>(DEG.) | a <sub>i</sub><br>(DEG.) | DEG.) | d <sub>l</sub><br>(A.U.) | / <sub>1</sub><br>(A.U.) | 9 <sub>1</sub><br>(DEG.) | (DEG.) | h <sub>i</sub><br>(DEG.) |
|---------|----|-----------------------------|--------------------------|--------------------------|-------|--------------------------|--------------------------|--------------------------|--------|--------------------------|
| MERGURY |    | 4.0923                      | 31.2                     | 23                       | 73    | 0.3871                   | 0.08                     | 157                      | 7      | 45                       |
| VENUS   |    | 1.6021                      | 80.85                    | 0.76                     | 135   | 0.7233                   | 0.005                    | 232                      | 3.8    | 75                       |
| EARTH   |    | 0.9856                      | 99.2                     | 1.9                      | 105   | 1.0000                   | 0.16                     | 195                      | 0      | _                        |
| MARS    |    | 0.5240                      | 49.2                     | 11                       | 330   | 1.5237                   | 0.14                     | 60                       | 20     | 17                       |
| JUPITER |    | 0.083096                    | 316.2                    | 5                        | 12    | 5.2028                   | 0.26                     | 102                      | 1.3    | 99                       |
| SATURN  |    | 0.03345                     | 99.2                     | 6.5                      | 90    | 9.5385                   | 0.55                     | 180                      | 2.5    | 100                      |
| URANUS  |    | 0.011735                    | 98.4                     | 5.5                      | 170   | 19.182                   | 0.84                     | 254                      | 0.75   | 74                       |

 $a_i$ ,  $b_i$ ,  $f_i$ ,  $g_i$ ,  $l_i$  and  $h_i$  result from author's interpretation of the astronomy tables. Epoch: December 31, 1949

Table 2

| PLANET  |    |       |            |
|---------|----|-------|------------|
| MERCURY | P1 | 0.8°  | 0.38 A.U.  |
| VENUS   | P2 | 305.8 | 0.729 A.U. |
| EARTH   | P3 | 263.5 | 1.015 A.U. |
| MARS    | P4 | 4.7   | 1.41 A.U.  |



**CIRCLE INQUIRY NO. 7** 

Then the uncorrected angle is:

$$A_i = N * W_i + K_i$$

The corrected angle is:

$$A_i = A_i + C_i$$
 where  $C_i$  is obtained from the astronomy tables

With the corrected angle the planet's distance and latitude are obtained.

Di is obtained from the astronomy tables

Li is obtained from the astronomy tables

If the uncorrected angle exceeds 360° then its value is reduced by

$$A_i$$
 (uncorrected) = 360°\*Frac (Ai/360°) before finding  $C_i$ .

The procedure is repeated for all planets of interest including Earth. At the time of writing this article, the author used the date June 15, 1977. The resulting solutions are provided in Table 2 and Figure 5.

The observer then plots the relative positions of the planets as in Figure 5. For example to find Venus, the observer determines the relative angle between Venus and Earth.

$$Z = (A3-A1)$$

The triangle of Venus, Earth, and the Sun might not be (not seldom is) a right triangle. Therefore, the observer solves for

$$Q = \sqrt{D2^2 + D3^2 - 2*D2*D3*COS(Z)}$$

The angle between the Sun and Venus is

 $X = \{ angle for which the Sin (X) = D2*Sin (Z) \}$ 

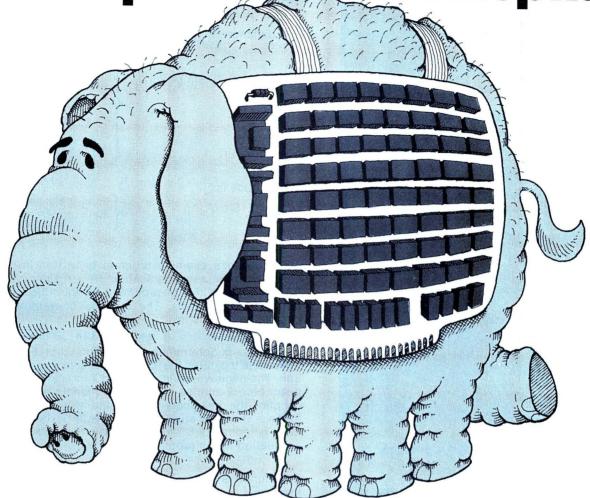
 $X = Sin^{-1} (D2*Sin (Z)/Q)$ 

Or the observer decides to measure the angle X graphically with a protractor.

### PROGRAM SOLUTION

The program solves the problem, identical to the conventional solution, except the program generates  $C_i$ ,  $D_i$  and  $L_i$  from equations rather than from tables. The equations are of the form:

ARTEC Introduces
The Expandable 32K Elephant



### The 8K-32K Expandable Memory That Grows With Your System

Now, for the first time, you can have a reliable true static memory that will grow with your system. Start with the board and 8K memory. Then add on one, two or three 8K increments of memory up to 32K. 250 ns access time. The Artec 32K Expandable Memory allows you plenty of room for memory and all necessary support hardware.

For five years Artec craftsmanship and reliability has been proven in tough industrial use. Now, you too can enjoy breadboards and memories that will work time after time. Boards like the GP 100 and the wire wrap WW-100. Send for an Artec Board, your order will be sent the same day as received.

Board & 8K of memory—\$290.00 8K add on kits—\$255.00 ea. Full 32K board—\$1,055.00



GP-100-\$20.00 Maximum design versatility along with standard address decoding and buffering for S-100 systems. Room for 32 uncommitted 16 pin IC's, 5 bus buffer & decoding chips, 1 DIP address select switch, a 5 volt regulator and more. High quality FR4 epoxy. All holes plated through. Reflowed solder circuitry.

WW-100-\$20.00

A wire wrap breadboard, similar to the GP 100. Allows wirewrap of all sizes of sockets in any combination. An extra regulator position for multiple voltage applications. Contact finger pads arranged for easy pin insertion.



**TO ORDER:** Use your Mastercharge or BankAmericard. Or just send along a money order. Your order will get same day service.

FOR MORE INFORMATION: For more information about these or any of Artec's complete line of circuit boards or for either industrial or personal use, please call or write. A catalogue will gladly be sent.

| Please    | send me:     |          |      |
|-----------|--------------|----------|------|
| □ 32K     | ☐ GP-100     | □ WW-    | -100 |
| ☐ I've e  | enclosed a m | oney ord | er.  |
|           | ☐ Mastercha  |          |      |
|           | □ BankAmer   |          |      |
| Name      |              |          |      |
|           |              |          |      |
| Address . |              |          |      |

10% discount for students & computer club members.

ARTEC ELECTRONICS, INC.

605 Old County Rd. • San Carlos, CA 94070 • (415) 592-2740

## Xlpha Supply Company Distributor For Computing Supplies



The KAS-ETTE/10" library case provides an ideal means of handling, storing and shipping diskettes.

Special offer on Scotch Brandtm save'n store diskettes. These Diskettes are IBM compatible, with oxide formula especially developed to withstand heavy use.

### Five ways to buy diskettes

Single Sided:

11 IBM compatible diskettes for the price of 10.

Price: \$60.00 Catalog #740S

10 IBM compatible diskettes in IXAS-ETTE/10" storage

Catalog #740K Price: \$60.00 10 Shugart-type diskettes in IXAS-ETTE/10 storage

Catalog #740-K-32 Price: \$60.00

**Double Sided:** 

10 IBM compatible diskettes in KAS-ETTE/10" storage unit.

Catalog #740/2K Price: \$80.00

10 Shugart-type diskettes in IKAS-ETTE/10 storage unit. Catalog #740/2K-32 Price: \$80.00

Diskette Labels. 30 labels per pack in assorted colors.

Offer good through August 31, 1977. Minimum order \$10. Shipped via UPS prepaid. Order now, or write for more information.

| <ul> <li>Send the following items</li> </ul> |           | Send information only to: |       |  |
|--|-----------|---------------------------|-------|--|
| Name   |           |                           |       |  |
| Street                                       |           |                           |       |  |
| City   |           | _ State Zip               |       |  |
| Quantity                                     | Catalog # | Unit Price                | Total |  |
|  |           |                           |       |  |
| Send check or Mastercharge:  Bank # M/C #    |           | TOTAL                     |       |  |
|  |           | 6 % Tax*                  |       |  |
|  |           | Amt. Enclosed             |       |  |

lpha Supply Company

\*Calif. Res. add 6% sales tax

18350 BLACKHAWK ST., NORTHRIDGE, CA 91326 PHONE (213) 360-0612

**Dealer Inquiries Invited** 

**CIRCLE INQUIRY NO. 92** 

 $C_i = a_i * Sin (a_i - b_i)$ 

A<sub>i</sub> = uncorrected angle a<sub>i</sub> = peak correctionb<sub>i</sub> = apparent phase

The corrected angle is:

$$A_i = A_i + C_i$$

The distance is:

$$D_i = d_i + f_i*Sin(A_i-g_i)$$

A<sub>i</sub> = corrected angle di = mean distance from Sun to P<sub>i</sub> in Astronomical Units (A.U.)

f<sub>i</sub> = peak deviation of D<sub>i</sub> from d<sub>i</sub> g<sub>i</sub> = apparent phase

offset of Di

The latitude is:

$$L_i = I_i * Sin (A_i - h_i)$$

$$\begin{cases} I_i = \text{ peak value of } L_i \\ h_i = \text{ apparent phase } \\ \text{ offset of } L_i \end{cases}$$

The author's example program is written in BASIC (intended for a language such as Robert Uiterwyk's 8K BASIC version 1.0). The argument for the trigonometric functions are radians. The author's conversion from degrees to radians is:

A (radians) = A (degrees) $\star$ 3.14159/180°

The program determines the positions of Earth and Venus and indicates the location of Venus relative to the Sun. The negative values of X and T indicate Venus appears before sunrise of that day. Planets are near the ecliptic (the imaginary line in the sky that the Sun follows). For deviation from the ecliptic latitude, (Li) must be computed. The reader may choose to add this calculation to the program.

Line numbers 152 to 165 and 230 to 265 solve the problem for

$$A_i = 360^{\circ} *Frac (A_i/360^{\circ})$$

If the reader's language has an integer function, then:

Frac 
$$(\alpha) = \alpha$$
-Int  $(\alpha)$ 

Line numbers 400 to 440 solve the equation:

$$X = Sin^{-1} (D2*Sin (Z)/Q)$$

by realizing that if:

$$X = Sin^{-1}(\alpha)$$
 then:  $\alpha = Sin(X)$ 

so:

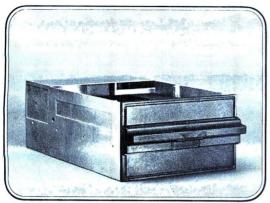
$$\alpha$$
-Sin (X) = O (D2/Q)\*Sin(Z)-X = O

X, the unknown is determined by "successive substitution." Other root solving algorithms are permitted but require more programming and memory. If the reader's language does not solve trigonometric functions, substitute a piecewise linear approximation, Talor series or other accurate trigonometric algorithm.

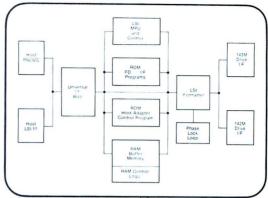
A suggested addition to the author's program includes adding a routine to calculate N given the date.

If the reader decides to expand the program to include the outer planets (Mars and beyond) additional programming steps are required. The  $Sin^{-1}(\alpha)$  function is defined from -90° to +90°. However, the outer planets sometimes exceed these limits. The extra programming steps required are to keep track of the quadrants of the respective planets, and then decide upon the appropriate value of X.

## Meet the First Family in floppies.



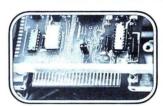
The roots of our floppy family



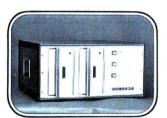
1143M controller • LSI technology • 1K buffer



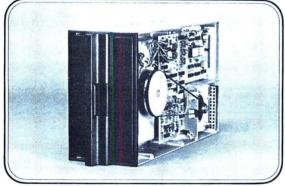
Dual head



50 pin LSI interface



1149M Multipurpose Cabinet assembly. Rack or table mounted.



New 143M disk drive. Two-sided recording. Single/double density. LSI Multifunction.

LSI-11 RS-232-C S-100 BUS

Our host adaptors

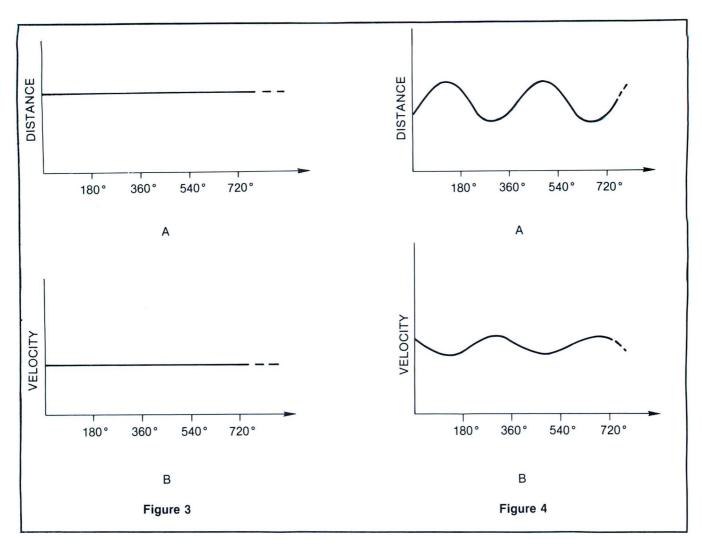
CalComp's got it all together for you. A total floppy family. Any way you want it...single products or the total package. In every case you get *true* multifunction, LSI technology, high MTBF and low MTTR reliability, compatibility and multiple interfaces.

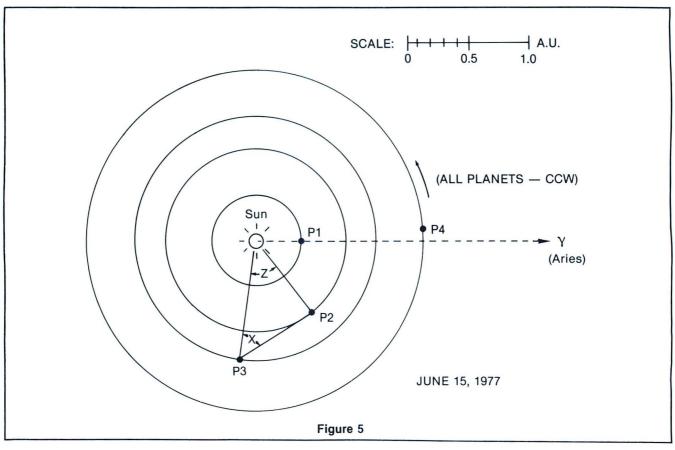
And that's not all. Field-proven double density—now one or two-sided. And our new 1143M controller along with three host adaptors.

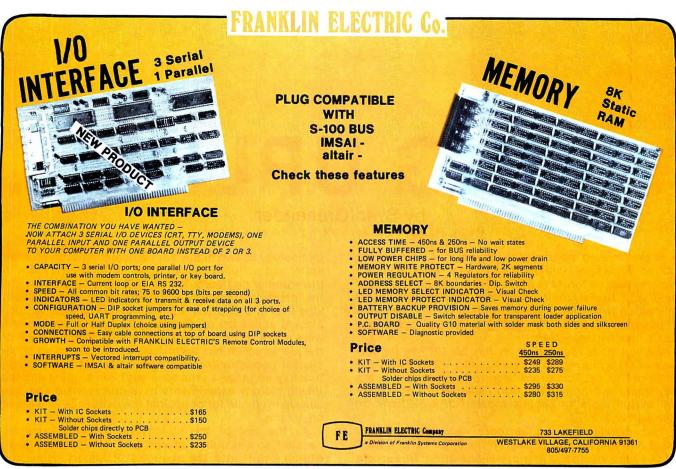
With CalComp it's all there. Choice. Flexibility. Everything you need for all or part of a total memory subsystem. *Plus* CalComp's worldwide service to support our family. We've delivered 50,000 drives—why not add your application requirements to our growing family.

Just call us or use the coupon. We'd like to tell you more about our family.









### **CIRCLE INQUIRY NO. 18**

```
155 GUTO 170
TO FIND THE POSITION OF VENUS
ENTER THE NO. OF DAYS SINCE 12/31/49
                                                      160 A3=A3-2◆P0
                                                      165 6010 152
 10028
                                                      170 PRINITUNCORRECTED AS =" +AS+P2
UNCORRECTED AS =
                                262.7968
                                263.5148
  CORRECTED AS =
                                                      175 C3=1.9+(P1)+SIN(A3-105+P1)
                                305.706
                                                      180 A3=A3+C3
UNCORRECTED HS =
                                                      185 PRINT" CORRECTED A3 =",A3+P2
                                305.8352
  CORRECTED AS =
                                                      200 W2=1.602+P1
                                                      210 K2=80.85+P1
  D2 =
                .72858256E+00
                                                      220 HZ=N+W2+K2
                1.0148888
  I03 =
   0 =
                                                       230 IF A2 >= 2◆PO THEN 260
                .68364746E+00
                                                       250 GDTO 270
 VENUS IS AT:
                                                       260 A2=H2-2*P0
               -45.85
                               DEGREES
                                                       265 6010 230
   × =
                                                       270 PRINT"UNCORRECTED A2 =" ,A2+P2
   DR
               -3.0566667
                               HOURS
                                                       275 (2=0.8*(P1)*SIN(A2-135*P1)
   [ =
FROM THE SUN
                                                       280 H2=H2+C2
                                                       285 PRINT" CORRECTED A2 =" ,A2+P2
                                                       300 D3=1.0+0.016+SIM(A3-195+P1)
LINE 00490
END
                                                       310 D2=0.7233+0.0055+SIN(A2-232+P1)
                                                       320 Z=A2-A3
Ŧ.
                                                       330 Q=SQR(D2◆D2+D3◆D3-2◆D2◆D3◆CBS(Z))
                                                       340 PRINT'
                                                       350 PRINT"
                                                                  D2 =" ,D2
                                                       360 PRINT" D3 =",D3
                                                       370 PRINT"
                                                                   0 =" ,0
                                                       400 X=-P0/2
                                                       410 Y=(D2/Q)◆SIM(Z)+SIM(X)
                                                       420 IF Y >= 0 THEN 455
                                                       430 X=X+P0/3600
LIST
                                                       440 60TO 410
100 PRINT"TO FIND THE POSITION OF VENUS"
                                                       455 T=X◆12/P0
105 PRINT"ENTER THE NO. OF DAYS SINCE 12/31/49"
                                                       460 PRINT"
110 INPUT N
                                                       465 PRINT" VENUS IS AT:"
115 P0=3.14159
                                                       470 PRINT"
                                                                    X =",X◆P2,"DEGREES"
120 P1=P0/180
                                                       475 PRINT"
                                                                    DR"
125 P2=180/P0
                                                       480 PRINT"
                                                                    T =" ,T ,"HOURS"
130 W3=0.9856♦P1
                                                       485 PRINT" FROM THE SUN"
140 K3=99.2◆P1
                                                       490 END
150 A3=N+W3+K3
                                                       Ŧ.
152 IF H3 >= 2+P0 THEN 160
```





# VIKING UPLINK...

### by Sven Grenander

NASA, Jet Propulsion Laboratory, Pasadena, California

In the frenzied months of the summer of '76 while the United States celebrated its 200-year experiment in Nationhood, an intent team of scientists and engineers held vigil beside their equipment monitoring the activities of two little spidery robots travelling towards, entering orbit and safely landing on the surface of our sun's fourth planet, Mars.

Viking I made touchdown on July 20, 1976 on the surface of Mars in a region located at 19.5N,34W called the Plain of Chryse. This event occurred seven years to the day from the first manned moon landing. Viking II landed on the Plain of Utopia, located 22.4N,225.8W on September 3, 1976.

Immediately upon landing both Viking crafts began transmitting data and photos to the JPL "Earth Base." At this time Viking II is in winter hibernation. This article describes the communication system between Viking I and the scientists. The programs published here are actual printouts of "conversations" with the lander during the evening of June 23, 1977.

This communication is effected through three modes: REC-recorded through the orbiter, RCE-relayed through the orbiter and DCS-direct to earth from the lander. A sol is a Martian day. A signal travels through space an average of 18 minutes.

-editor

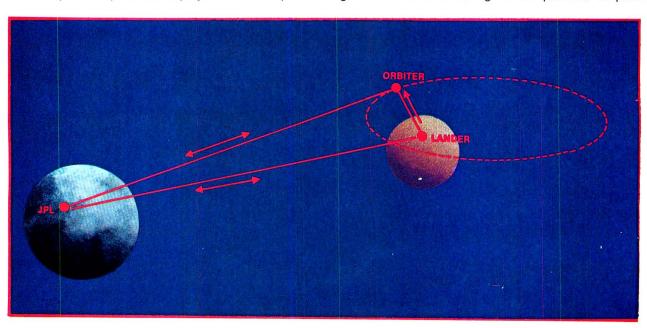
### INTRODUCTION

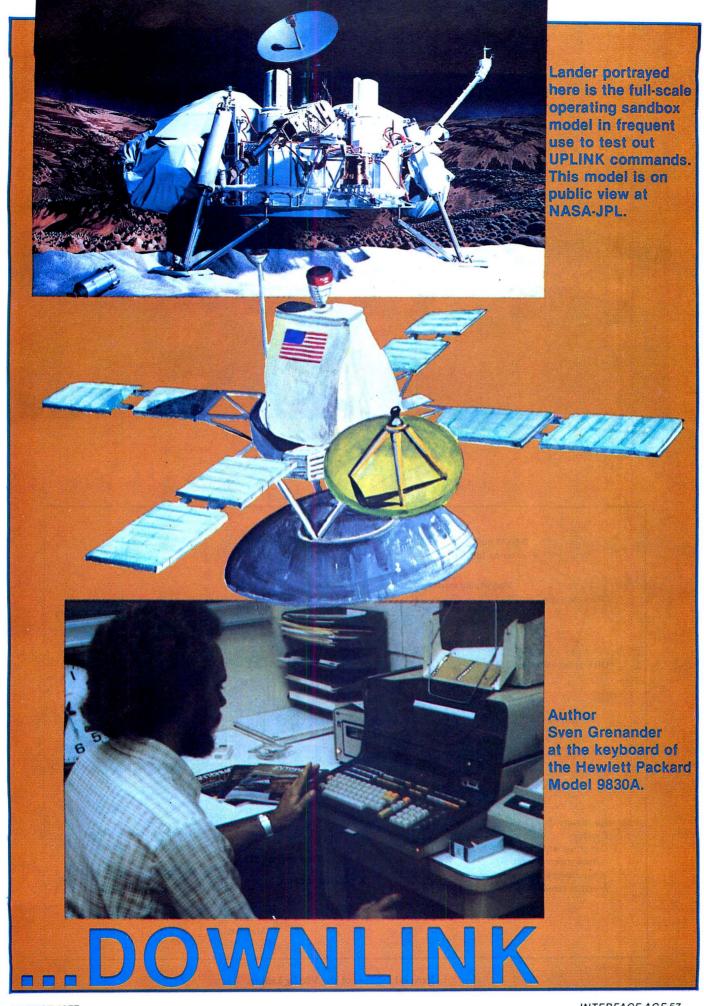
The Viking Project provided the world with yet another couple of impressive displays of current space

technology as two highly sophisticated spacecraft were softly and perfectly placed upon the Martian surface in the summer and early fall of 1976. The landing caught the attention of not only scientists around the world but also that of a public which had gradually become complacent about the exploration of our solar system. We were about to get our first close look at the surface of the planet which has traditionally been the home of our closest non-terrestrial neighbors, the Martians. Unfortunately no green aliens have yet been sighted and the Viking biology experiments have still to yield any conclusive evidence for or against the existence of Martian organisms.

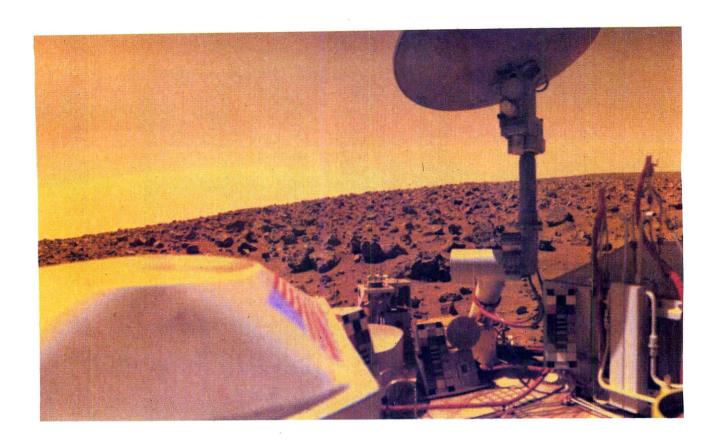
As the last of the biology experiments were exhausted, so was public interest and Viking started its inexorable drift into the shadows of history. None the less, on the Martian surface there are still two very active landers neither of which has shown any sign of wishing to fade into history quite yet. At the time of this writing, one lander (VL-2) is in a state of partial hibernation while weathering out the severe Martian winter. The other (VL-1) is still actively digging in the soil as evidenced by an ever-growing number of surface sampler trenches seen in the pictures taken by the lander cameras and returned to earth every few days.

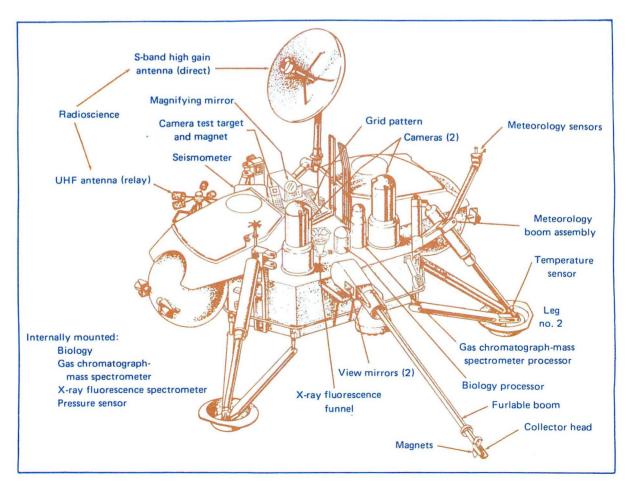
Three desktop computers are playing an integral part in this successful operation of the surface samplers and lander cameras. These computers are employed by the surface sampler and lander imaging teams in the generation and checking of all planned sequences





AUGUST 1977 INTERFACE AGE 57





-External features of the Viking Lander.

58 INTERFACE AGE AUGUST 1977

which are to be sent to the landers. The process requires a great deal of precise bookkeeping and the equipment has to be available at any time without prior notice. Minicomputers were chosen for the task because of their stand-alone nature which in effect gives them a higher degree of reliability than larger systems which must be shared with other users and which would require a major effort to be brought back into operation in the event of a systems crash.

The computers used are Hewlett Packard 9830A's, two of which have INFOTEK memory boards while the third has a Hewlett Packard memory. The INFOTEK cores were chosen because INFOTEK could offer 16K words of memory, whereas Hewlett Packard could only provide 8K at the time of purchase. Even 16K is somewhat inadequate and has strongly influenced the structure of the programs used. The relative slowness of the machines has also caused problems at times, but even so, the wisdom of choosing minicomputers for the job can hardly be denied. Their ease of operation and almost trouble-free history has more than made up for their lack of size and speed.

### **EQUIPMENT DESCRIPTION**

The computers are Hewlett Packard Model 9830A's which program in Hewlett Packard BASIC. The 9830 has an internal cassette drive which holds a tape with a capacity of about 32K words, twice the maximum memory available.

The INFOTEK memory boards are model EM-30 and hold 16K words or 32K bytes. The memory was supplied with a fast BASIC ROM also by INFOTEK. The special operations available with the ROM will be outlined below.

A remote cassette memory is also being used. It is another Hewlett Packard product, Model 9865A. The remote cassette drive has the unexpected advantage of being able to mark 10% more files than the internal drives.

The Plotter is a Hewlett Packard 9862A with a plotter surface of 10 by 15 inches and an electrostatic platen which has turned out to work very well. The plotter uses felt-tip pens which is probably all that is needed because of the accuracy available in the pen movements. Any finer writing instrument would tend to increase the visibility of the plotter steps.

A general design phone coupler is also used at times to interface the HP with the other machines. The interface has not been used as extensively as was expected because of the selfsufficiency of the HP and the low baud rate available.

The ROMS used were, the fast BASIC supplied by IN-FOTEK, a plotter control ROM by HP, an advanced programming I ROM by HP, an advanced programming II ROM by HP, a data communications I ROM by HP, a data communications III ROM by HP, an extended I/O ROM by HP, a string variables ROM and a matrix operations ROM.

The fast BASIC ROM supplied a *send* function which sends the contents of one array of matrix into another without requiring that a BASIC loop be set up—and at 200 times the speed of the equivalent loop. It also made it possible to program the choice of printall which determines if all displays are to be printed or not. And it also gives a Frac command which is the inverse of the INT or Integer command.

The plotter control ROM serves the obvious function of controlling the operation of the plotter.

The advanced programming I and II ROMS have overlapping features and the AP II ROM was discarded in favor of the more useful fast BASIC ROM. The functions provided are: *transfer* which puts string variables into numerical strings, *sort* which is used to sort numeric or string arrays, the *beep function* which allows a beep to be programmed so as to alert the operator of something which has to be done or to indicate that the program has reached a certain point in its execution.

The data communications ROM supplies the text option which allows text to be entered in to a program-type file. It also allows the other features necessary for telephone or hardwire communications with other computer installations.

The extended I/O ROM is intended for use with peripherals which were never acquired such as digitizers, card readers and the like.

The string variables ROM is needed to allow alphanumeric inputs and processing. Without it all inputs would have had to be numeric which would have proved very cumbersome.

The matrix operations ROM is used for all matrix operations which would otherwise have had to be ruled out.

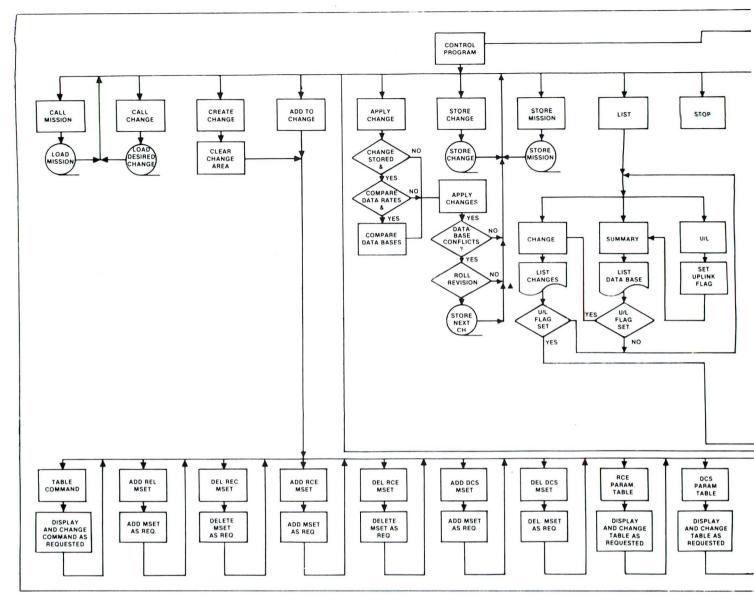
The machines are used mainly in the generation of SIPS, the medium through which the science teams communicate their instructions to the rest of the project and ultimately to the landers. The acronym SIP stands for Science Instrument Parameter listing and a description of its contents and generation requires that a brief introduction be given as to how the science teams control their instruments.

Communications with the spacecraft are divided into UPLINK and DOWNLINK where UPLINK is the use of a radio link to send commands up to a receiving spacecraft and DOWNLINK is the use of a link to return data to earth. UPLINKS are grouped into cycles, each cycle spanning about two weeks' worth of lander activity and usually having two to three UPLINKS associated with it. DOWNLINKS occur with less regular frequency and use three modes of data return; RCE, DCS and REC. Both RCE and DCS links operate in real time, RCE links employ an orbiter to relay the signal from lander to earth and DCS links transmit directly from lander to earth. REC DOWNLINKS use an orbiter to store and delay transmission until a suitable link can be established, REC is short for "recorded."

At the beginning of the planning for a cycle the science teams are given the UPLINK and DOWNLINK schedule and are told how many UPLINK words are available for instrument control and how many megabits of data can be downlinked. It is then up to the teams to agree how these allocations are to be split up between the different experiments in order to maximize the return of useful data and to start laying out sequences which can be accommodated within the given allocations

These sequences are put into SIP form by coding all instructions in a format which can be read by the project computers responsible for further encoding, testing and finally radio transmission. Depending upon the instrument concerned, the SIP will also contain other pertinent information which may be needed for an understanding of the contents and possible error searching.

The teams hand in their first SIP at what is called the preliminary SIP port and a number of computer simulations are run to determine if there are any problems. The problems which will turn up are usually scheduling conflicts or allocation overruns. Each science team is responsible for checking the output of a simulation called LSEQ (Lander SEQuence of events) to determine for which if any problems they are responsible. If a team is involved in a conflict it will have to rewrite the SIP and resubmit it at the final SIP port after which all simulations are rerun and another LSEQ run is produced. If problems still remain in the final LSEQ run, then the team will once again have to rewrite and resubmit the SIP at



the adaptive SIP port and all simulations are rerun a third time. There is still one more chance to correct the SIP after the adaptive LSEQ run has been reviewed. That is at the late adaptive SIP port, but such corrections are avoided if at all possible because there is usually insufficient time to run the simulations between the late adaptive SIP port and the time of the actual UPLINK.

For each lander there are usually upwards of three SIPS in a state of flux at any one time. The process of sequence generation, checking and rechecking requires so much time that two consecutive cycles have to be in a state of planning and simultaneously giving rise to a situation which lends itself to momentary confusion and numerous mixups. However, it is to the credit of this cautious, if somewhat cumbersome system, that both landers are as operational today as they were upon the day of landing.

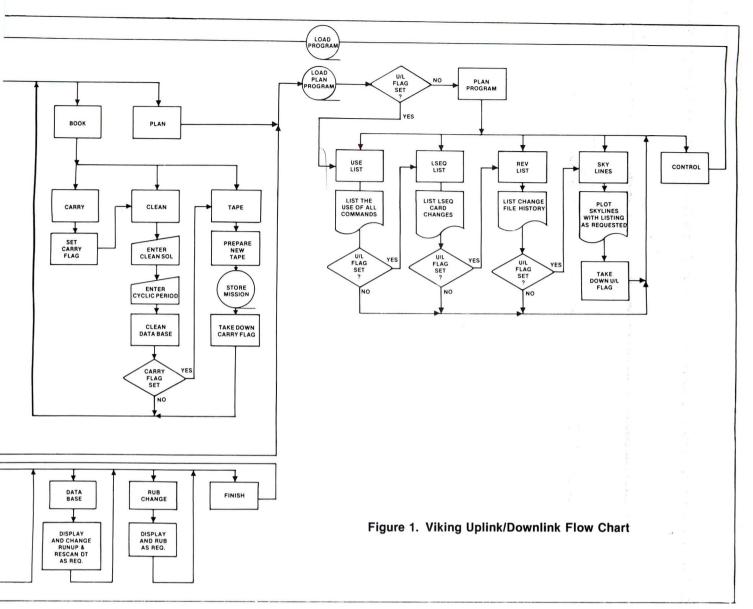
The bookkeeping task is further complicated by the cumulative nature of the UPLINKS. Each UPLINK changes the contents in the on-board computer into a configuration which will cause the planned sequence to be executed. Thus any change in any one UPLINK has to be rippled down through the bookkeeping of all successive UPLINKS so that the changes planned for later UPLINKS are indeed applicable to the on-board computer load at the time of the UPLINK.

### THE PROGRAM

The lander imaging team uses the program which is

flowcharted in Figure 1 and listed in Figure 2 (see page 78) to track the data base in the on-board computer and to generate the SIPS needed for future changes and sequences. The program was written in the spring of 1976 when prelanding exercises showed the impossibility of manual tracking. The principal author of the program is William R. Patterson of Brown University who managed to write the code in addition to his other responsibilities as a camera engineer. The program is still being tweaked on an almost weakly basis to further improve its performance. Most of these changes have to do with additional tasks which should be incorporated but others are made to speed up the running or simplify operation.

The program actually consists of two programs because of size limitations of the memory. The programs are loaded into memory as needed and are called control and plan. The control program contains all the bookkeeping operations and some listing routines; plan is only used to generate listing and plots. The programs are written in Hewlett Packard BASIC which is very similar to most other forms of BASIC or FORTRAN, A Hewlett Packard remote cassette memory is used to hold the programs during use and the internal cassette drive is reserved for the data tapes holding the UPLINKS. One data tape is used for each UPLINK, each tape holding a small bookkeeping file, a data base file (the data base as it should appear after the previous UPLINK), and twenty change files. The data base is referred to as the "Mission" in the program while the change files are called



"Change." Because of two-program interfacing it is necessary to hold the Mission file and current Change file in common memory, the Mission being array PI(186,10) and the Change being CI(101,11). The "I" in the array name designates that the arrays are of integer precision, once again because of storage space shortage. Figure 3 is a listing of a typical Mission file and shows how some data compression had to be used to fit the whole mission into a matrix of size 186 by 10. Figure 4 shows the corresponding Change file and how it is structured.

The structure of each tape is shown in Figure 5. Each Change file contains all the changes present in the previous Change file unless the change was created from scratch or previous changes have been selectively rubbed as described in a later section. A Mission file is generated by applying all the changes in a designated Change file to the data base which resides in the onboard computer before the UPLINK. This apply operation will also be discussed in greater detail further on.

### GENERATION OF A SIP (Science Instrument Parameter)

PREPARING AN UPLINK TAPE: The generation of a SIP starts with the red-lining of a markup copy. The markup copy is a copy of the data base as it should appear after the previous UPLINK and red-lining it simply means that the copy is altered by marking the desired changes in red. This red-lined copy is given to the data base tracker

who pulls out the program tape and loads the control program into memory and also into the special key functions which are used to speed up the entry of repetitious program commands. If this red-lined copy is the first of an uplink, the previous uplink tape will be put into the internal cassette drive and the command "Call MI" will be entered in response to the prompting by the computer: "Enter control level command." "Call MI" is short for "Call Mission" and causes the loading of the Mission file from the UPLINK tape in the tape drive. The program will ask for another control level command after the mission has been loaded and this time the entry will be "Call CH" which causes a Change file to be loaded. The program will come back to ask "Latest change?" to which the answer is usually "Y" or "Yes." If the answer is "No," the program will respond "Enter desired REV NO." and the number of the desired Change file has to be entered. To assure that the correct file is being pulled, the program prints the number of the Change file requested, who generated it and when, then asks if that is indeed the correct file. When the Change file has been pulled the operate will answer "apply CH" to the program prompting. The program will ask if a "Database Compare" is required to which the answer is almost invariably "Yes." The apply operation causes all the changes to be applied to the data base, giving the UPLINK as it would look after the UPLINK. The Database Compare option searches through the data base and Change file to make sure that no changes have been rolled into the

data base which would cause the changes to be invalid as they stand. The program will enquire if a "REV Roll" is desired in the case of a data base conflict. In the case of a REVROLL the computer can fix the Change file so that it will match the current data base, at other times the program will not know how to make the fixup and will simply list the problem areas, leaving it up to the operator to make the fix.

The above sequence "Call MI", "Call CH" and "Apply CH" will give the data base of the UPLINK which was handed over as the red-lined copy. To get a tape to operate on for this desired UPLINK the operator enters into the "Book" subsection of the control program by answering "Book" to the control level command prompting. The program will ask for a "Bookkeeping Command" to which the answer is "Tape." The tape command will cause the program to request that a blank (or old tape) be put in the internal drive in place of the one used to generate the data base. Once this tape has

been put into place and the program has been instructed to "continue," the calculator will proceed with the marking of the tape into files of the size and number needed. The mission in the calculator will be stored in the Mission file and the operator will be asked who he is, what the data is and which UPLINK tape has just been prepared. All this additional bookkeeping information is also stored on the tape before the program returns to the control section.

CREATING A CHANGE FILE: After an UPLINK tape has been prepared as described above the operator can proceed with the creating of a Change file in accordance with the instructions on the red-lined copy. The program will still be in the control section after the completion of the "Tape" command issued in the previous section and the operator will input "Create CH" in response to the prompting by the calculator. "Create CH" causes the Change file in the calculator to be set to zero so that a

| 111111111111110000000000000000000000000  |
|--|
| 2 10300<br>3 10300<br>4 10401<br>5 10401<br>6 10403<br>8 10313<br>9 10313<br>8 10313<br>9 10313<br>1 10208<br>4 10213<br>6 10213<br>8 2011<br>2011<br>2011<br>2011<br>2011<br>2011<br>2011<br>2011   |
| 1022 1031 1011 1012 1022 1032 1033 1033  |
| 7755000555555550000555050005555500000000   |
| 8755151500<br>4000<br>4000<br>31000<br>2500<br>31000<br>2500<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>310000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>31000<br>3100 |
| 8 12109 9 12111 -40 12111 -10 1211 -10 1211 -10 1211 -10 1211 -10 1211 -10 1211 -10 1211 -10 121 -10   |
| 3230<br>11230<br>11645<br>2230<br>3250<br>3250<br>3250<br>3250<br>3250<br>3250<br>325  |
| 3901<br>5202<br>57022<br>57022<br>6101<br>5801<br>5801<br>5901<br>3901<br>3901<br>4302<br>4402<br>4502<br>4401<br>4402<br>3901<br>4302<br>4401<br>4502<br>4502<br>4502<br>4502<br>4502<br>4502<br>4502<br>4502   |
| 3. Vi  |
| 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  |
| 9556789810123456789981123455678998112345567898112345567898112345567898112345567898112345567898112345567898112345567898811234556789881123455678988112345567898811234556789881123455678988112345567889881123455678898811234556788988112345567889881123455678898811234567889888811234567889888112345678898881123456788988811234567888888888888888888888888888888888888   |
| 104401<br>104403<br>104403<br>104408<br>15400<br>12710<br>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  |
| 1022<br>1021<br>1021<br>1023<br>1011<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1021<br>1023<br>1023   |
| 555556662246666666666666666666666666666  |
| 220000000000000000000000000000000000000  |
| 88888888888888888888888888888888888888   |
| 00000000000000000000000000000000000000   |
|  |
| ***************************************  |
| 00000000000000000000000000000000000000   |
| @@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@@   |

new set of changes can be entered. Figures 6a and 6b show how the data base is listed in the data base summary and this is the listing which has been red-lined. The operator goes through the listing and performs the changes required.

COMMAND TABLE CHANGES: Command table changes are made by keying in "Table C" in response to the prompting by the calculator: "Enter Change Command". "Table C" and most of the other Change commands have been stored on immediately executing special keys so that the operator does not have to spell it out every time. The calculator will respond to the Change command by asking what is the "Command Number." The answer will be any number from 1 to 99 which will cause the display of the data base gain of the command in question. If the gain is correct the operator hits the space bar execute; if not, the correct gain is keyed in. The DR (Data Rate), CH (photosensitive diode #), MD (mode of sampling), OFF-SET, DCI (Dark Current Inhibit), "Start Azimuth," "End Azimuth" and elevation pointing angle of the camera are all gone through using the same technique. Space bar for "No change" and corrected value if there is a change.

RECORDED MSET CHANGES: The recorded MSETs control the execution of the commands listed in the command table and are structured as shown in the recorded MSET listing shown in Figure 7. Unlike the command changes, the changes to the recorded MSETs have to be in the form of a "Delete MSET" or "Add MSET". Once again the special function keys are used, "Add MSET" being used to add and "Del MSET" being used to delete. A new MSET is entered by giving the sol (Martian day since landing), hour, minute and second of the MSET upon request. Next the cyclic status of the MSET is entered as is the command number and camera. If cyclic is given as 1 that will cause the MSET to be automatically repeated every 20 days, otherwise it would only be used once. The command number called is the same as that listed in the command table and the choice of camera 1 or 2 depends for which the command was designed. The last inputs are "Pre-Cal," "Post-Cal," "Stow," "Rescan," and "Dust." PRE-CAL and POST-CAL will cause the camera to perform a calibration before or after the picture is taken. The Stow option causes the camera to stow behind the protective post after the execution of the command so as to avoid unnecessary exposure to the atmosphere and dust. Rescan is an option which will cause the camera to scan one azimuth line repeatedly at the end of the picture. The duration of the Rescan is determined by the RESCAN DT given at the end of the data base summary. The Rescan option is used to detect any motion in or across the line which is imaged. The Dust option controls the dusting of the camera window, an operation which is performed by a small nozzle placed above the window which blows CO2 across the window to clear it of dust if needed. Recorded MSETs are deleted in the same manner as they are added but only requiring that the time and camera be specified.

ADDING AND DELETING DCS AND RCE MSETS: DCS and RCE MSETs are different from REC MSETs in that they do not explicitly cause a command to be executed but refer to an RCE or DCS parameter table to get the command number to be used. The duration of the image, the camera number and the "Stow" or "No-Stow." The MSETs are entered and deleted by using the appropriate special function key; ADD RCE, DEL RCE, ADD DCS and DEL DCS. Whatever the operation, the input will be the sol, hour, minute and second of the MSET and the parameters and options to be used.

RCE AND DCS PARAMETER CHANGES: The parameter changes are made by executing the appropriate special function key, then specifying the parameter and option

to be changed. The program is written the same way for parameter changes as for command changes in that it displays the current value of the command, duration, camera and *stow* and expects a space bar *execute* in the case of "no change" and a corrected value if there is to be a change.

DATA BASE CHANGES: This change of the data base refers only to the portion containing the RESCAN DT and "Runup.Rescan" listed at the end of the data base. Executing the special function key "Data Base" will cause the current value of the RSCN.DT to be displayed as for command changes, then the "Runup.Rescan" will be displayed expecting the same kind of action, space bar or correct value.

THE RUB FUNCTION: "Rub" is used when a change is to be deleted as opposed to something already contained

| 13:39-3-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-13:39-14-14-13:39-14-14-14-14-13:39-14-14-14-14-14-14-14-14-14-14-14-14-14- | 4227 4406 4496 4496 4496 4521 1500 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 4001 4001 4001 4001 4001 4001 4001 1900 11700 11700 11700 11700 11700 11800 11800 11800 11800 1800 | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | 00000000000000000000000000000000000000 | 7000 7000 7000 8000 8000 8000 8000 8000 | 10-00-00-00-00-00-00-00-00-00-00-00-00-0 | e e e e e e e e e e e e e e e e e e e | 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 00000000000000000000000000000000000000 | 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 |
|---|--|--|---------------------------------------|--|---|--|---------------------------------------|---------------------------------------|--|---------------------------------------|

330 Dated June 23, 1977.

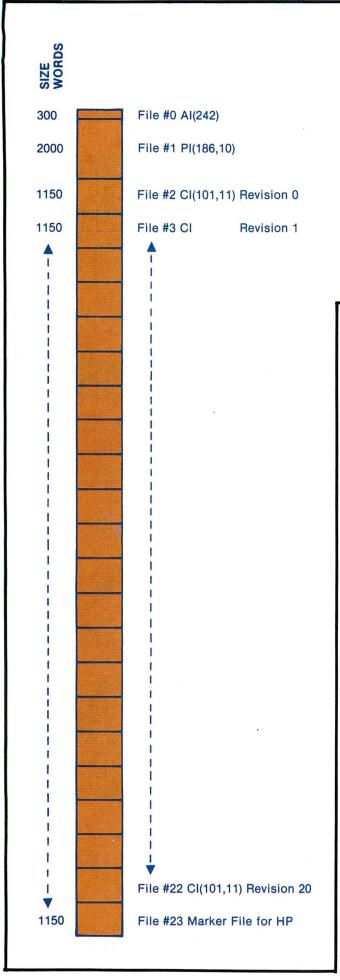


Figure 5. The UPLINK tapes contain a total of 24 files. The first file holds the array Al(242) which is used for tape bookkeeping. It includes the most recent revision of the previous UPLINK and the sol of said UPLINK, the number of the operator who created the tape, the date on which it was created and the same information for each of 21 possible Change files which may have been stored on the tape.

The second file holds the mission, i.e. the result of the previous UPLINK as it currently stands or as it was when the mission was most recently rolled forward. The file size is 2000 out of which 1860 are used by the 186 by 10 integer precision P matrix.

The next 21 files are used to store the Change files. Each file having a size of 1150 out of which 1111 is used for the 101 by 11 C matrix. The HP refers to the first file as file 0 so that AI is stored in 0, PI is stored in 1 and the changes are stored in 2 through 22. There is also one empty file at the end of each tape with the same size as the previous file. This is only a marker file used by the HP to find the end of the tape for further markings.

in the data base before the UPLINK. If an MSET has been entered incorrectly the special function key used to enter the MSET is once again used but this time in upper case. The program will display the added MSETs as they are stored in the Change file and ask if the change currently displayed is the one to be rubbed. The answer is either "Y" for "Yes" or space bar for "No." Table command changes are rubbed by first executing the "Rub" special function key, then entering the number of the command change to be rubbed plus 1000. (Figure 2: See lines 1220 through 1310).

RCE parameter changes, DCS parameter changes and Data Base changes are most easily rubbed by rechanging the values back to what they were originally and then letting the data base compare in the Apply program find the null change and erase it with a REV roll as outlined earlier. These changes can be rubbed using the rub function directly but it involves entering a calculated value which is usually impractical.

FIN OR FINISH: The FIN operation is used after all changes have been entered and the change section of the program is to be exited. The operation causes the changes to be sorted and rubs to be executed.

### ADDITIONAL COMMANDS — CONTROL

ADD TO CHANGE: "Add to" is used if a Change file is to be added to, as opposed to being created from scratch. Since the SIP generation is iterative it usually takes between 5 and 15 revisions to get a product which is acceptable. When a Change file is added to it will contain all its initial changes in addition to any that are added with the exception of changes which have for some reason been rubbed in the adding to process. All operations are the same when making changes after the "Add to" command as they were after the "Create CH" command given above.

APPLY CHANGE: The Apply option is used to apply all changes in the current Change file to the data base in the current Mission file. This operation is quite time consuming. It usually took between 5 and 45 minutes during the primary mission and still takes up to five minutes today with the use of the *send* command supplied by the fast BASIC ONE ROM from INFOTEK. The send command shifts the contents of arrays at a speed which is up to 200 times faster than the equivalent BASIC loop and is one of the commands which is not usually available to the BASIC user. The use of the "Apply CH" was outlined in the section describing how UPLINK tapes are prepared but one feature was not mentioned. The apply change will not allow a data base com-



Viking photographs a Martian dust storm. In this picture from Viking Orbiter 2, a turbulent, bright dust cloud (arrow) more than 300 kilometers (186 miles) across can be seen inside the great Argyre Basin. It is apparently moving eastward under the influence of strong winds that also create condensate lee-wave clouds to the west of the basin. This is the first color picture of a dust storm taken from a spacecraft orbiting the planet. Large depressions like Argyre and Hellas seem to be favored locations for the formation of dust storms. The great Argyre Basin in the southern hemisphere of Mars is one of several enormous depressions created by the impact of large asteroids early in the planet's history.

AUGUST 1977 INTERFACE AGE 65

pare if the Change file being applied has not been stored first. The reason for this is that confusion would arise if database conflicts were found and corrections stored before the initial Change file had been stored.

STORED MISSION: Store MI is used to store the result of an *apply* on the UPLINK tape following the one in which the *apply* was performed. The *apply* will have produced a Mission file which will look like the one on the on-board computer after the UPLINK and that is therefore the data base of the subsequent UPLINK. The number of the operator, the data and UPLINK number will also be stored along with the rest of the mission. (Figure 7)

STORE CH: Store CH is used to store the change currently residing in the computer and as with the "Store Mission" command the operator number, data and UPLINK sol are also stored. The number of the revision is internally tracked and stored along with the rest of the information.

LIST: There are three list options in the control program: Change, Summary and U/L (for UPLINK). "Change" causes the listing of the current change file to be listed as shown in Figure 8. Summary gives a listing of the

data base or mission currently in memory as shown in Figure 7. U/L is used when a whole UPLINK package or SIP is to be produced. It will generate both the Change listing and the Summary listing while being in the control program, then call in the plan program and list the LSEQ summary, Use List REV record and Skyline listings and plots as described in the plan section below. The operator is asked to give the date and time of the listing so that the different listings can be identified. A problem which occurred with some frequency before this addition was made was that two listings existed with the same revision number but with different missions as the base and it was not always apparent which was the most current one.

BOOK: The tape option in the book subsection was described above. There are two more options: "Clean" and "Carry." The Clean operation is used to clean out all MSETs out of the data base which are no longer of any use because they have already been executed. It is easy to see that MSETs would keep adding up in numbers forever if the "clean" operation were not available. The Carry option simply performs the "clean" and "tape"

JUNE 23, 21:20
TRANS. MODE?REC
PICT. CLASS?ALL
PLOT??Y
PLOTTER
CONT

JUNE 23, 21:20

LIST OF ALL IMAGES BY REC MODE OF TRANSMISSION FROM RCE ON SOL 336 TO RCE SOL 338 PER VL 1 U/L- 330 REV. 8

### RECORDED IMAGING

| LIST<br>NO.<br>IMAGES | TYPE<br>PIC.<br>ON SOL | CAM.<br>_ 337 | START<br>AZ. | END<br>AZ.       | EPA            | TIME<br>HR.:MIN                      | CMD.          | BI1S<br>X10†6             | DUR.  |
|-----------------------|------------------------|---------------|--------------|------------------|----------------|--------------------------------------|---------------|---------------------------|-------|
| 1                     | SUN<br>GAIN:           | 1<br>Ø        | 247.5        | 250.0<br>REASON: | 14.4<br>: DAII | 9: 44<br>Y AM SUN D]                 | 40<br>ODE     | 0.23                      | 14.53 |
| 2                     | GAIN:                  | 2             | 185.0        | 187.5<br>PEASON: | 10.0<br>. sky  | 18: 41                               | 54<br>IC OTUI | 0.09                      |       |
| 3                     | GRN<br>GAIN:           | 2             | 185.0        | 187.5            | 10.0           | 18: 43<br>COLOR, OZON                | 55            | 0.09                      | 5.64  |
| 4                     |                        | 2             | 185.0        | 187.5            | 10.0           | 18: 45<br>COLOR, OZON                | 56            | 0.69                      | 5.64  |
| 5                     | GRN                    | 2             | 185.0        | 187.5            | 10.0           | 18: 47                               | 57            | 0.09                      | 5.64  |
| 6                     | BLU<br>GAIN:           | _<br>В        | 185.0        | 187.5<br>REASON: | 10.0<br>SKY    | COLOR, OZON<br>19: 18<br>COLOR, OZON | 58<br>58      | 0.09                      | 5.64  |
| 7                     | GRN                    | 2             | 185.0        | 187.5            | 10 0           | 19: 20                               | 50            | 0.00                      | 5.64  |
|                       |                        |               |              | TOTAL            | _ BITS         | COLOR, OZOM<br>THIS MODE/S           | OL:           | 0.77                      |       |
| IMAGES                | ON SOL                 | 338           |              |                  |                |                                      |               |                           |       |
| 8                     | SUN<br>GAIN:           | ุ 1           | 247.5        | 250.0<br>REASON: | 14.4<br>: Dell | 9: 44<br>Y AM SUN D]                 | 40            | 0.23                      | 14.53 |
| 9                     | BB1                    | 2             | 150.0        | 155.0            | 0.0            | 12: 24                               | 48            | 0.45                      | 27.86 |
| 10                    | BB1                    | 2             | 27.5         | 35.0 -           | -10.0          | ACE SAMPLER                          | 49            | 0.66                      | 41.20 |
| 11                    | SUK                    | 2             | 152.5        | 162.5 -          | -30.0          | IEL THROUGH<br>13: 5<br>ACE SAMPLER  | 17            | $\alpha$ . $\circ \alpha$ | 18.98 |
|                       |                        |               |              | NEGOOM           | OURT           | HOL OHNELER                          | I I KENU      | ≥Π                        |       |

TOTAL BITS THIS MODE: 2.42

# OSBORNE & ASSOCIATES, INC.

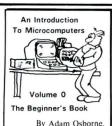


# The World Leaders In Microprocessor Books



Many books on microprocessors and their use are now on the market, and most of them have names that sound alike. But Osborne & Associates' books have dominated this market since 1975, when our first book appeared. With rave reviews from all over the world — with more than five hundred university text adoptions, our books are all best sellers. In fact, "An Introduction To Microcomputers: Volume I — Basic Concepts" now holds the world's record in sales volume for any textbook sold for a profit.

If you want information on microprocessors, begin with the Osborne books.



"An Introduction To Microcomputer: Volume 0 — The Beginner's Book" By Adam Osborne.

This is the book for the absolute beginner. Assuming that you know nothing about computers, math or science of any kind, this book explains what computers are all about — and it takes you to the point where you can read Volume I. 300 pages.

Book No: 6001 \$7.50 Available October 31, 1977.



For the microcomputer user, a series of books provide complete programs, written in BASIC. All these books are by Lon Poole and Mary Borchers.

"Some Common Basic Programs" 200 pages.

"Payroll With Cost Accounting — In Basic". 400

pages Book No.: 22002 \$12.50
"Accounts Payable and Accounts Receivable"

Book No.: 23002 \$12.50 Available November 30, 1977

"General Ledger System"

Book No.: 24002 \$12.50 Available December 31,



"An Introduction To Microcomputers: Volume I — Basic Concepts" By Adam Osborne.

The world's best selling textbook. This book explains, clearly, concepts common to all microcomputers, yet specific to none. 350 pages.

Book No.: 2001 \$7.50



ASSEMBLY LANGUAGE PROGRAMMING

BY LANCE LEVENTHAL

"8080A and 8085 Assembly Language Programming" By Lance Leventhal.

This book is for the assembly language programmer or student; it explains assembly language programming for the 8080A and 8085 microcomputers. The book contains numerous examples. 400 pages.

Book No.: 31003 \$7.50 Available October 31, 1977



"An Introduction To Microcomputers: Volume II — Some Real Products" (Revised June 1977) By Adam Osborne, Susanna Jacobson and Jerry Kane.

This book describes every common microprocessor and all of their support devices. Information is new and clearly written. Only data sheets are copied from manufacturers. 1200 pages.

Book No.: 3001 \$15.00



The "Programming For Logic Design" series of books show how to use microprocessors in a digital logic environment.

"8080 Programming For Logic Design" By Adam Osborne. 300 pages.

Book No.: 4001 \$7.50

"6800 Programming For Logic Design" By Adam Osborne. 300 pages.
Book No.: 5001 \$7.50

"Z80 Programming For Logic Design" By Adam Osborne and Susanna Jacobson. Book No: 7001 \$7.50 (Available November 30,

### OSBORNE & ASSOCIATES, INC. . P.O. BOX 2036 . BERKELEY, CA 94702 . DEPT. C

| TITLE  | UNIT PRICE  | QUANTITY |
|--|-------------|----------|
| Volume I — Basic Concepts (#2001)                      | \$7.50 ea.  |          |
| Volume II — Some Real Products (#3001)<br>revised 1977 | \$15.00 ea. |          |
| 8080 Programming For Logic Design (#4001)              | \$7.50 ea.  |          |
| 6800 Programming For Logic Design (#5001)              | \$7.50 ea.  |          |
| Some Common BASIC Programs (#21002)                    | \$7.50 ea.  |          |
| Payroll With Cost Accounting (#22002)                  | \$12.50 ea. |          |

We will only invoice for purchase orders of over 10 books. Shipping charges for bulk orders to be arranged.

Check or Money Order enclosed (Calif. residents include sales tax)

| NAME/COMPANY |  |
|--------------|--|
|--------------|--|

----

CITY, STATE AND ZIP

TELEPHONE

Please check one space below:

4th Class Mail Delivery (3-4 weeks within the U.S.A.)

I have included \$.50 per book for U.P.S. (allow 10 days)

I have included \$1.50 per book for special rush shipment by air.

I have included \$.50 per book foreign surface mail.

I have included \$3.00 per book for foreign airmail.

 I require information on consignments, discounts and distributors outside the U.S.A.

AUGUST 1977 CIRCLE INQUIRY NO. 42 INTERFACE AGE 67

command sequentially so that the operator does not have to sit idly by waiting for the tape program to come back with questions every five or ten minutes.

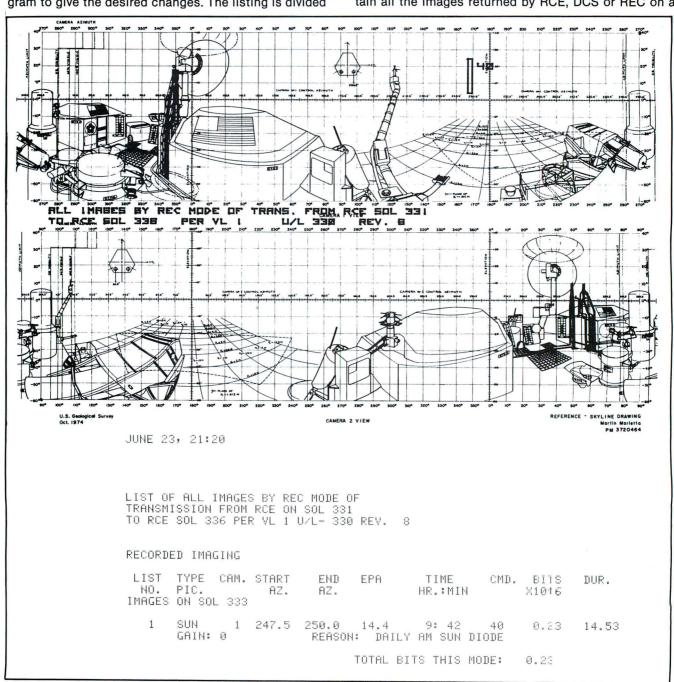
PLAN: Plan is the last command to be executed in the control section of the program. It causes the plan program to be loaded, giving access to the options available in that program. The load time is on the order of a few minutes and puts some limitation on how many times the operator is willing to switch back and forth between the two programs. All the following operations are performed after entering the plan program.

USE LIST: The "Use List" command causes the program to go through the whole Mission file and find when and how each command is used, then list them in chronological order as shown in Figure 9. The list is used when planning a new UPLINK because it tells the reader which command can be changed and which have yet to be used for their designated purpose.

LSEQ: The "LSEQ" command gives a printout of the computer cards which are to be fed to the LSEQ program to give the desired changes. The listing is divided

into four parts, "Insert table changes," "Remove table changes," "Insert MSET changes" and "Remove MSET changes." The use of Insert change is straightforward, a change is simply to be added. Remove change on the other hand is not so simple. In the case of a change to an MSET change the old MSET change has to be removed, then the new one inserted. Command changes are removed if a previously submitted command change has been rubbed completely. If a command change has simply been rechanged it would only show up on the Insert list as a "was"-"now" input where the "was" lists the change which is to be replaced and the "now" is what is to replace it. The LSEQ list is the most important part of the whole lander imaging SIP. It alone would be enough to command the lander if no mistakes were ever to be made so that no supplemental information was needed. A typical LSEQ listing is shown in Figure 10.

sky: "Sky" is a command which is used to plot the images to be taken on what is called a skyline drawing. A typical skyline is shown in Figure 6. The skylines are plotted on a return-to-return basis, i.e. a skyline will contain all the images returned by RCE, DCS or REC on a



# ONE MEGABYTE ON LINE

### FOR YOUR ALTAIR/IMSAI

### \$685 COMPLETE

### **Available Now from Listed Dealers**

- Load Named Files Under MITS Basic.
- Access any File within 34 Seconds.
- · Load Basic in 10 Seconds.
- Cassettes 100 percent interchangeable with no adjustments.
- Applications Programs Available on MECA Format Cassettes.
- · Powerful Operating System
- · Update Files / Data in Place
- Separate Audio Track allows Computer Control of Voice Responses.
- Eliminates Need for ROM/PROM Monitors
- Presently in use with MITS, IMSAI, POLY 88, Z-2, ZPU



Business Applications: Ideal for Mailing Lists, Payroll, Billing, and Backing Store for Disk-Based Systems.

Educational Applications: Using the Unique Audio Capability is ideal for Spelling Tutor, Vocabulary Training, Language Training, etc.

Development System: Ideal as the Heart of a Low Cost Development System. Operating System includes Powerful File Management Capabilities plus an Assembler, Editor, Debug Routine, Tape Copy Routine, and Directory Reconstruction Program.

Hobbyist System: Allows creation of talking games, intelligent phone answering System, Audio Burglary Deterrent.

Prices:

ALPHA-1/2\* as shown, Complete with Controller Card, Two Drives, Power Supply, Enclosure, Cable, Manual and Operating System.

Kit \$685 Assembled & Tested \$965

\*Single to Quad Drive Systems Available.

See a Demonstration of the ALPHA-1 System Today at the Following Dealers:

### THE COMPUTER STORE

820 Broadway Santa Monica, CA 90401 (213) 451-0713

### THE COMPUTER MART 633-B Katella Ave.

Orange, CA 92667 (714) 633-1222

### COMPUTER KITS

1044 University Ave. Berkeley, CA 94710 (415) 845-5300

### COMPUTER STORE OF SAN FRANCISCO

1093 Mission Street San Francisco, CA 94103 (415) 431-0640

### **COMPUTER SHACK**

3120 San Mateo N.E. Albuquerque, NM 87110 (505) 883-8282, 883-8283

### ALTAIR COMPUTER CENTER

611 N. 27th St., Suite 9 Lincoln, NE 68503 (402) 474-2800

### GATEWAY ELECTRONICS, INC.

OF COLORADO 2839 W. 44th Ave. Denver, CO 80211 (303) 458-5444

### ALTAIR COMPUTER CENTER

110 The Annex 5345 East Forty First St. Tulsa, OK 74135 (918) 664-4564

### ALTAIR COMPUTER CENTER

5750 Bintliff Drive Houston, TX 77036 (713) 780-898

#### COMPUTER PRODUCTS UNLIMITED

2412 S. Broadway Little Rock, AR 72206 (501) 371-0449

### THE COMPUTER STORE OF ANN ARBOR

310 East Washington St. Ann Arbor, MI 48104 (313) 995-7616

### COMPUTER STORE OF DETROIT

505-507 West 11 Mile St. Madison Heights, MI 48071 (313) 545-2225

### THE COMPUTER SYSTEMCENTER

3330 Piedmont Road Atlanta, GA 30305 (404) 231-1691

### CHICAGO COMPUTER STORE

517 Talcott Rd. Park Ridge, IL 60068 (312) 823-2388

#### COMPUTERS-TO-GO

4503 West Broad St. Richmond, VA 23230 (804) 335-5773

Or Write / Phone: III Ca, 7344 Wamego Trail, Yucca Valley, CA 92284 • (714) 365-7686

AUGUST 1977 CIRCLE INQUIRY NO. 27 INTERFACE AGE 69

| JUNE 23, 21:20  | JUNE 23, 21:20  |
|---|---|
|   | JUNE 23, 21:20<br>SIP NO: VL 1- 330 U/L-CAM-REV 8   |
| SIP NO: VL 1- 330 U/L-CAM-REV 8  VIKING LANDER CAMERA SYSTEM  COMPLETE DATA BASE SUMMARY  (SCIENCE INSTRUMENT PARAMETER LIST)   | CMD +++ COMMAND TABLE +++ START END NO. GRIN DR. CH. MD. OFF DCI R2. R2. EL 1 0 5 2 1 0 775 5 87.5 0 0 2 3 0 5 2 1 0 775 5 87.5 0 0 0 2 3 0 5 2 1 0 0 775 5 87.5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  |
| JUNE 23, 21:20  | 23 2 1 8 2 1 9 75.0 157.5 -50   |
| SIP NO: VL 1- 330 U/L-CRM-REV 8   | 24  |
| 324 13: 18: 55 0 46 1 0 0 0 0 0 0 324 13: 20: 46 0 43 1 0 0 1 0 0   | JUNE 23, 21:20<br>SIP NO: VL 1- 330 U/L-CAM-REV 8   |
| 324 13: 22: 47 0 44 2 0 0 0 0 0 0 3 324 13: 23: 58 0 45 2 0 0 1 0 0 0 324 13: 23: 58 0 45 2 0 0 1 0 0 0 324 16: 38: 45 0 37 2 0 0 1 0 0 0 325 9: 34: 9 0 39 1 0 0 1 0 0 0 326 7: 0: 0 0 99 1 0 1 1 0 0 326 9: 34: 34 0 39 1 0 0 1 0 0 0 326 9: 34: 34 0 39 1 0 0 1 0 0 326 10: 0: 0 0 48 1 0 0 1 0 0  |   |
| 326 10: 0: 0 0 48 1 0 0 1 0 0 0 3 3 3 5 6 10: 0: 0 0 99 2 0 1 1 1 0 0 0 0 3 3 5 7 9 1 3 4 5 9 0 0 3 9 1 0 0 0 1 0 0 0 0 0 0 0 3 3 5 8 8 1 8 1 0 0 0 5 3 1 0 0 0 0 0 0 0 0 0 0 3 3 5 8 8 1 8 1 0 0 0 5 6 5 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0   | CRID  |
| JUNE 23: 21:20<br>SIP NO: VL 1- 330 U/L-CAH-REV 8   | 79 3 1 0 2 1 0 12.5 35.0 -20<br>80 4 1 1 1 0 280.0 325.5 -20<br>81 4 1 1 1 0 280.0 315.0 -20<br>82 4 1 8 2 1 0 182.5 195.0 -50<br>83 4 1 8 2 1 0 205.0 227.5 -50  |
| RECORDED INAGING MSET TABLE. THE TOTAL NUMBER OF MSET ENTRIES IS: 94  SOL TIME CYC CMD. CAH. PFE POST STON RE- HR. MINISEC. NO. NO. NO. CAL CAL  328 16: 54: 0 0 68 1 0 0 0 0 0 0 0  328 16: 54: 0 0 68 1 0 0 0 0 0 0 0  328 17: 49: 0 0 68 1 0 0 0 0 0 0 0  328 17: 49: 0 0 65: 1 0 0 0 0 0 0 0  328 17: 49: 0 0 65: 1 0 0 0 0 0 0  329 9: 35: 48 0 39 1 0 0 1 0 0  329 9: 35: 48 0 39 1 0 0 0 1 0 0  330 9: 36: 13 0 39 1 0 0 1 0 0  330 14: 0: 0 0 79 2 0 0 1 0 0  331 9: 36: 38 0 39 1 0 0 1 0 0  333 9: 42: 27 0 40 1 0 0 1 0 0  333 9: 42: 27 0 40 1 0 0 0 1 0 0  333 9: 44: 60 40 1 0 0 0 0 0 0  333 9: 44: 60 40 1 0 0 0 0 0 0  333 18: 41: 36: 0 0 55: 2 0 0 0 0 0 0  337 18: 47: 0 0 55: 2 0 0 0 0 0 0  337 18: 47: 0 0 55: 2 0 0 0 0 0 0  337 18: 47: 0 0 55: 2 0 0 0 0 0 0  337 19: 81: 7: 0 0 55: 2 0 0 0 0 0 0 0  337 19: 81: 7: 0 0 55: 2 0 0 0 0 0 0 0  337 19: 18: 47: 0 0 55: 2 0 0 0 0 0 0 0  337 19: 18: 47: 0 0 55: 2 0 0 0 0 0 0 0  337 19: 18: 47: 0 0 55: 2 0 0 0 0 0 0 0  337 19: 18: 0: 0 55: 2 0 0 0 0 0 0 0 0  337 19: 18: 0: 0 55: 2 0 0 0 0 0 0 0 0  337 19: 18: 0: 0 55: 2 0 0 0 0 0 0 0 0  337 19: 20: 0 55: 2 0 0 0 0 0 0 0 0  337 19: 20: 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 0 55: 2 0 0 0 0 0 0 0 0  337 19: 44: 10 0 0 55: 2 0 0 0 0 0 0 0 0  338 39: 44: 11: 0 0 0 55: 2 0 0 0 0 0 0 0 0  339 39: 44: 11: 0 0 0 55: 2 0 0 0 0 0 0 0 0  331 19: 44: 10 0 0 0 55: 2 0 0 0 0 0 0 0 0  331 19: 44: 10 0 0 0 0 0 0 0 0 0 0 0 0 0  332 19: 44: 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 | 76  |
| 337 9: 44: 6 0 40 1 0 0 1 0 0 0 3 337 18: 41: 6 0 54 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  | JUNE 25: 21:20 SIP:NO: VL 1- 330 U/L-CAM-REV 8  |
| 337 18: 47: 0 0 57 2 0 0 1 0 0 337 19: 18: 0 0 58 2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0   | DCS PARAMETER TABLE   |
| 338 12: 53: 40 0 49 2 0 0 1 0 0 3 338 13: 5: 0 0 17 2 0 0 1 0 0 0 3 339 13: 5: 0 0 17 2 0 0 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0   | TABLE OPT. CHD. DUP. CAH. STOH  1   |
| 354 10: 0: 0 1 71 1 0 0 1 0 0 0 354 10: 0: 0 1 82 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0   | DCS MSET TABLE. SOL TIME PAP. OPTIONS   |
| 354 10: 26: 0 1 84 1 0 1 1 0 0 0 359 9: 15: 0 1 90 1 0 0 1 0 0 0 359 9: 15: 0 1 90: 0 1 76 2 0 1 1 0 0 0 0 0 359 9: 15: 0 1 90 1 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0  | SOL HR.:HIH:SEC PAP. OPTIONS HR.:HIH:SEC PAP. |
| Figur   |   |

| F 7 0 - 1   |  |                 |
|---|--|-----------------|
| Figure 7. Cont.   |  |                 |
|   |  | JUNE 25.4.21:20 |
| SIP NO: VL 1 330 U L CAM-   | PEV 8  |                 |
| RCE PAPAMETER TABLE   |  |                 |
| TABLE OPT. CMD. DUP.  |  |                 |
| 1 1 11 96.0<br>1 2 12 170.0<br>1 3 13 494.4<br>1 4 14 100.0<br>1 5 15 100.0<br>2 1 2 2 2 448.0<br>2 4 2 488.0<br>2 5 25 488.0<br>2 6 26 438.0   | 2 1 1 1 2 1 2 2 1 2 2 1 1 1 1 1 1 1 1 1  | i               |
| RCE MSET TABLE  |  |                 |
| HR.:MIN:SEC   | . OPTIONS  |                 |
| 322 10 14 52 1 3244 9 8 488 1 1 3244 9 8 488 1 1 3247 10 0 0 0 1 3247 10 0 0 0 1 3341 10 0 0 0 1 339 16 0 0 0 1 339 16 0 0 0 1 339 16 0 0 0 1 3341 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 0 1 3441 12 30 0 | 12. 95 9: 45 9: 00 9: 00 9: 00 9: 00 9: 00 123: 456 11: 44 11: 44 12: 55 3: 66 |                 |
| SIP, NO: WL 1- 330 U L CAM  |  | JUNE 23. 21:20  |
| PSCN.DT 1500.00 SE RUNUP.RESCAN 1.20 SE   | EC.  | PLETE LIST:     |

specified link, show where the pictures are located, which commands were used, which camera, the time of the pictures, how many megabits of data they used, the duration of the images, the gains used and finally what were the reasons for the pictures. The skylines are produced on a Hewlett Packard 9862A plotter of 15 by 10 inches. (See Figures 6a and 6b and listing).

REV RECORD: The "Rev Record" lists the history of an UPLINK package. It lists the number of the revisions; on which sol the UPLINK is to take place; on which date the rev was created and by whom. The primary purpose of the listing is to simplify error searching by immediately defining who did what, when. Figures 11a and 11b show the revision record for the SIP of the 330 UPLINK.

CONTROL: The "CONT" or "Control" command reloads the control program in place of plan. Thus if a skyline has shown that too many megabits were used on a particular return the operator will return to the control program to make a new revision which will hopefully bring the data within allocation.

### ADDITIONAL BOOKKEEPING

In addition to the bookkeeping performed in the programs there is also manual bookkeeping to keep track of the automated bookkeeping. There are three things which have to be tracked: what changes were rolled where and when, why was a revision created and finally which revision was used to create a SIP which was submitted to LSEQ.

Two charts are kept for this bookkeeping, one being a subset of the other. Figure 11b shows the chart on which LSEQ submissions and revision reasons are tracked. It also tracks the operator who created the changes, when the change was made, which revision of the previous UPLINK was used to create the data base,





### LOW COST! Model 753 **ASCII Keyboard** Kit or Assembled

- 53 Keys, popular ASR-33 format
- Rugged G-10 P.C. Board
- Tri-mode MOS encoding
- Two-Key Rollover
- MOS/DTL/TTL Compatible
- Upper Case lockout
- Data and Strobe inversion option
- Three-User Definable Keys
- Low contact bounce
- Selectable Parity
- MORE! Custom Keycaps



### Optional keyboard enclosure

Durable enclosure made of long-lasting ABS plastic. custom fit for the Model 753. Complete with all hardware. Color: Medium grey.

### **Pricing Information**

Model 753 (Assembled) \$71.25 Model 753K (Kit)..... 59.95 Model 701 Enclosure..... 14.95

For Quantity Prices, Contact GRI Direct.

If not available at your local computer store, contact GRI direct

### GEORGE RISK INDUSTRIES, INC.

G.R.I. PLAZA KIMBALL, NEBRASKA 69145 TELEPHONE (308) 235-4645 TWX 910-620-940





\* "See us at Booth 137 in Atlantic City"

|              |             |                     |             |               |                    |                   |             | JUNE            | 23, 21:               | 20             |
|--------------|-------------|---------------------|-------------|---------------|--------------------|-------------------|-------------|-----------------|-----------------------|----------------|
|              |             |                     |             |               |                    |                   |             | JUNE            | 23, 21:               | 20             |
|              |             |                     |             |               |                    |                   |             |                 |                       |                |
| IP N         | ): VL       | 1- 330              | UZE-C       | AM-REV        | 8                  |                   |             |                 |                       |                |
| °L I H       | K SUMM      | ARY                 |             |               |                    |                   |             |                 |                       |                |
|              |             |                     |             |               |                    |                   |             |                 |                       |                |
|              |             |                     |             |               |                    | 8                 |             |                 |                       |                |
| IP N         | 0: VL       | 1- 330              | UZL-0       | AM-REV        | 8                  |                   |             | JUNE            | 23, 21:               | 20             |
|              |             |                     |             |               |                    |                   |             |                 |                       |                |
| ABLE         | OF IM       | IAG ING             | COMMAN      | D CHAN        | IGES:              |                   |             |                 |                       |                |
|              | CMD.<br>NO. | GAIN                | DR.         | сн.           | MD.                | OFF               | DC I        | START<br>AZ.    | ENI<br>AZ.            | EL             |
| AS:<br>IOW:  | 17          | 3<br>4              | \$#\$<br>1  | 13<br>14      | 2 3                | \$ \$ \$<br>1     | \$\$\$<br>0 | 275.0<br>152.5  | 280.0<br>162.5        | -26<br>-36     |
| IAS∶<br>IOW: | 40          | 1                   | \$\$\$<br>1 | \$\$\$<br>4   | \$\$\$<br>2        | ###<br>1          | \$\$\$<br>0 | ######<br>247.5 | \$\$\$\$\$\$<br>250.0 | \$\$1<br>20    |
| iAS∶<br>IOW: | 41          | 2                   | \$\$\$<br>1 | \$\$\$<br>4   | \$\$\$<br>2        | \$ <b>\$ \$</b> 1 | \$\$\$<br>0 | 170.0<br>172.5  | 172.5<br>175.0        | \$\$\$<br>2(   |
| IAS∶<br>IOW: | 48          | 4 3                 | \$\$\$<br>1 | 5 8           | \$\$\$<br>2        | \$\$\$<br>1       | \$\$\$<br>0 | 160.0<br>150.0  | 167.5<br>155.0        | -16            |
| IAS:<br>IOW∶ | 49          | \$\$\$<br>4         | \$\$\$<br>1 | 0<br>8        | ###<br>2           | 1 ± ±<br>1        | \$\$\$<br>0 | 180.0<br>27.5   | 260.0<br>35.0         | -36<br>-16     |
| IAS:<br>IOW: | 54          | \$\$ <b>\$</b><br>2 | \$\$\$<br>1 | 4             | <b>###</b><br>3    | ###<br>1          | \$\$\$<br>0 | 327.5<br>185.0  | 330.0<br>187.5        | \$ \$ :<br>1 ( |
| iAS:<br>IOW∶ | 55          | 1 2                 | \$\$\$<br>1 | 4 2           | <b>\$\$\$</b><br>3 | 1 # #<br>1        | \$\$\$<br>0 | 165.0<br>185.0  | 167.5<br>187.5        | 1 1 1          |
| IAS:<br>IOW: | 56          | 0                   | \$\$\$<br>1 | 4             | ###<br>3           | ###<br>1          | ###<br>0    | 172.5<br>185.0  | 175.0<br>187.5        | \$\$:<br>1     |
| lAS∶<br>lOW: | 57          | 4                   | \$\$\$<br>1 | 1 2           | 1 3                | 1 1 1<br>1        | \$\$\$<br>0 | 285.0<br>185.0  | 295.0<br>187.5        | -16<br>16      |
| WAS:         | 58          | 5                   | \$\$\$<br>1 | \$ \$ \$<br>1 | 1 3                | 16                | \$\$\$<br>0 | 235.0<br>185.0  | 275.0<br>187.5        | \$ \$ 1        |

Ample Juice



Constant voltage power supplies by Parasitic Engineering.

Give your Altair, IMSAI or custom system the power it needs to keep your programs up and running through brownouts and power fluctuations. The famous Parasitic Enginering Constant Voltage Power Supplies deliver full output with line voltages as

low as 90 volts or as high as 140 volts. 12-amp kit designed for Altair 8800-(A), \$90 postpaid. Universal 20-amp kit, \$200 postpaid. (Cal. res. add tax).

Thinker Tovs

1210 10th St., Berkeley, CA 94710

See it at your local computer shop.

Or place BAC/MC orders to 800-648-5311.

"See us at Atlantic City"

STP NO: VL 1- 330 U/L-CAM-REV 8

CHANGES TO THE MSET TABLE FOR RECORDED IMAGING:

| SOL  | TIME<br>HR:MIN:SEC.  | CYC. CMD.  | CAM. PRE<br>NO. CAL   | POST<br>CAL                             | STOW                                    | RE- DU<br>CAN                           | JST                                     |
|--|--|--|---|---|---|---|---|
| ADD: 333<br>ADD: 337<br>ADD: 337<br>ADD: 337<br>ADD: 337<br>ADD: 337<br>ADD: 337<br>ADD: 338<br>ADD: 338<br>ADD: 338<br>ADD: 338<br>ADD: 338<br>ADD: 359<br>ADD: 359<br>ADD: 359<br>ADD: 359<br>ADD: 359<br>ADD: 364<br>ADD: 369<br>ADD: 369<br>ADD: 369<br>ADD: 369<br>ADD: 369 | 9: 42: 27<br>9: 44: 27<br>18: 41: 36<br>18: 43: 0<br>18: 45: 0<br>18: 45: 0<br>19: 18: 0<br>19: 18: 0<br>19: 28: 0<br>19: 28: 0<br>10: 53: 48<br>13: 5: 0<br>9: 44: 56<br>12: 0: 0<br>9: 45: 21<br>9: 15: 0<br>10: 0: 0<br>10: 20: 0<br>10: 20: 0<br>10: 23: 0<br>10: 20: 0 | 0 40<br>0 40<br>0 55<br>0 55<br>0 55<br>0 57<br>0 58<br>0 59<br>0 40<br>0 40<br>0 47<br>0 40<br>1 79<br>1 79<br>1 79<br>1 81<br>1 82<br>1 79<br>1 83<br>1 76<br>1 79<br>1 79<br>1 79<br>1 79<br>1 79<br>1 79<br>1 79<br>1 79 | 1122222221222121112211122   | 000000000000000000000000000000000000000 | 110001101111111111110011111111111111111 | 000000000000000000000000000000000000000 | 888888888888888888888888888888888888888 |
| DEL: 339 DEL: 339 DEL: 339 DEL: 344 DEL: 344 DEL: 344 DEL: 344 DEL: 349 DEL: 349 DEL: 349  | 10: 0: 0 10: 20: 0 10: 23: 0 10: 26: 0 10: 30: 0 9: 15: 0 10: 0: 0 10: 20: 0   | 1 90<br>1 72<br>1 79<br>1 81<br>1 71<br>1 82<br>1 83<br>1 84<br>1 76<br>1 72<br>1 79<br>1 79   | 1 0 0 2 0 0 1 0 0 1 0 0 1 0 0 0 1 0 0 0 1 0 | 000000000000000000000000000000000000000 | 1 1 1 1 0 0 0 1 1 1 1 1 1 1 1 1 1 1 1   | 000000000000000000000000000000000000000 | 999999999999                            |

JUNE 23, 21:20

JUNE 23, 21:20

JUNE 23, 21:20

CON DEE DOOT CTOU DE DUCT

SIP NO: VL 1- 330 U/L-CAM-REV 8

CHANGES TO THE DCS PARAMETER TABLE:

TAB. OPT. CMD. TIME CAM. STOW

FROM 3 3420.0 2 1 TO 2 1 3 1620.0 2 1

CHANGES TO THE DCS MSET IMAGING PARAMETERS:

|     | SUL | HR.: | 11H: |     | rns. | 0611 | UNS |  |
|-----|-----|------|------|-----|------|------|-----|--|
| ADD | 334 | 12   | 30   | 0   | 2    | 0,   | 0   |  |
| ADD | 338 | 16   | 30   | 0   | 2    | 0.   | 0   |  |
| ADD | 339 | 16   | 0    | 0   | 2    | 0.   | 0   |  |
| ADD | 344 | 13   | 0    | 0   | 2    | 1.   | 0   |  |
| ADD | 345 | 12   | 0    | 0   | 2    | ø,   | 0   |  |
| ODD | 210 |      | com  | 170 |      |      |     |  |

CHANGES TO THE RCE PARAMETER TABLE:

TAB. OPT. CMD. TIME CAM. STON SEC.

CHANGES TO THE RCE MSET IMAGING PARAMETERS:

|     | SOL |      | TIME |      | PAR.        | OPT  | IONS        |  |
|-----|-----|------|------|------|-------------|------|-------------|--|
|     |     | HR.: | HIH: | SEC. |             |      |             |  |
| ADD | 336 | 20   | 40   | 0    | 1           | 0,   | 0           |  |
| ADD | 338 | 16   | 30   | 0    | 1           | 0,   | ø           |  |
| ADD | 339 | 16   | 0    | 0    | 1           | 0,   | 0           |  |
| ADD | 341 | 14   | 0    | 0    | 1           | 0,   | 0           |  |
| ADD | 343 | 8    | 0    | 0    | 1 1         | 123, | 456         |  |
| ADD | 344 | 12   | 30   | 0    | 1           | 0,   | 0           |  |
| ADD | 345 | 12   | 0    | 0    | 1           | 0,   | 0           |  |
| ADD | 347 | 22   | 30   | 0    | 1           | 1,   | 0           |  |
| ADD | 360 | 17   | 58   | 0    | 2           | 1,   | 4           |  |
| ADD | 360 | 8    | 6    | 0    | 2           | 1,   |             |  |
| ADD | 365 | 17   | 58   | 0    | 2           | 2,   | 4<br>5<br>5 |  |
| ADD | 365 | 8    | 6    | 0    | 2           | 2,   | 5           |  |
| ADD | 370 | 17   | 58   | 0    | 2           | 3,   | 6           |  |
| ADD | 370 | 8    | 6    | 0    | 22222       | 3,   | 6           |  |
| DEL | 340 | 17   | 58   | 0    | 2           | 1,   | 4           |  |
| DEL | 340 | 8    | 6    | ø    | 5           | i,   | 4           |  |
| DEL | 341 | 14   | 0    | ø    | 1           | ø,   | ā           |  |
| DEL | 345 | 17   | 58   | 0    | 2<br>1<br>2 | 2,   | 9<br>5      |  |
| DEL | 345 | 8    | 6    | ø    | 2           | 2,   | 5           |  |
|     |     |      | -    | -    | -           | _,   | -           |  |

SIP NO: VL 1- 330 U/L-CAM-REV 8

JUNE 23, 21:20

IMAGING DATA BASE PARAMETER CHANGES:

WAS: 1500.00 NOW: RSCN.DT 1500.00

WAS: 2.50 NOW: RUNUP.RESCAN 1.20

\*\*\*APPROXIMATE U/L CONMAND WORD COUNT IS: 159 \*\*\*

| MINE   |   |  |  |  |   |                 |  | 3, 21:20   |   |   |  |  |                   |      |
|--|---|--|--|--|---|-----------------|--|--|---|---|--|--|-------------------|------|
|  | 23, 21:20                                       |  |  |  |   |                 | LIST O   | F THE ORDE   | R OF U  | ISE OF  | EACH COMMAN  | D IN MISSION VL 1  | U∠L 33 <b>0</b> , | REV. |
| IST (  | OF THE ORDER                                    | OF U   | SE OF I  | ЕАСН СОММАНЪ   | IN MISSION VL 1 U   | /L 330, PEV. 8  | смв.   | MODE   | CAM.  | SOL   | HR.:MIN.   | +*AZ.  |                   |      |
| MD.  |   |  |  |  |   | t soon her.     | 51   | REC  | 1   | 328   | 9: 55  | 0.83   |                   |      |
| np.  | MODE  | CHM.   | SOL  | HR.:MIN.   | **HZ.   |                 | 52   | REC  | 1   | 328   | 10: 35   | 0,83   |                   |      |
| 3  | DCS PRE   | 2  | 344  | 13: 0  | 10.00   |                 | 53   | REC  | 1   | 328   | 11: 55   | 0.83   |                   |      |
|  |   |  |  |  |   |                 | 54<br>54   | REC<br>REC   | 2   | 328<br>337  | 15: 0<br>18: 41  | 0.83<br>0.83   |                   |      |
|  | *   |  |  |  |   |                 | 55<br>55   | REC<br>REC   | 2   | 328<br>337  | 16: 10<br>18: 43   | 0.83<br>0.83   |                   |      |
|  |   |  |  |  |   |                 | 56   | REC  | 2   | 328   | 16: 50   | 0.83   |                   |      |
| 1 1  | RCE PRE   | 2  | 323  | 10: 14   | 17.50   |                 | 56<br>57   | REC<br>REC   | 2   | 337   | 18: 45   | 0.83   |                   |      |
| 1 1 1  | RCE PRE<br>RCE PRE<br>RCE PRE                   | 2 2 2 2  | 325<br>343<br>347  | 7: 21<br>8: 0<br>22: 30  | 17.50<br>17.50<br>17.50                                       |                 | 57   | REC  | 2   | 321<br>337  | 11: 11<br>18: 47   | 0.83<br>0.83   |                   |      |
| 12   | RCE PRE   | 2  | 323  | 10: 14   | 30.00   |                 | 58<br>58   | REC<br>REC   | 1 2   | 321<br>337  | 11: 27<br>19: 18   | 0.83<br>0.83   |                   |      |
| 12   | RCE PRE   | 2  | 343  | 8: 0   | 30.00   |                 | 59<br>59   | REC<br>REC   | 2   | 324   | 81 32  | 0.83   |                   |      |
| 14   | RCE PRE<br>RCE PST                              | 1  | 343<br>324   | 8: 0<br>9: 8   | 92.50<br>17.50  |                 | 60   | REC  | 2   | 337<br>324  | 19: 20<br>8: 41  | 0.83<br>82.50  |                   |      |
| 14   | RCE PST   | 1  | 343  | 8: 0   | 17.50   |                 | 61   | REC  | 1   | 321   | 11: 22   | 40.00  |                   |      |
| 15<br>15   | RCE PST<br>RCE PST                              | 2  | 324<br>343   | 9: 8<br>8: 0   | 17.50<br>17.50  |                 | 62   | REC  | 2   | 321   | 11: 9  | 10.00  |                   |      |
| 16   | RCE PST   | 2  | 343  | 8: 0   | 70.00   |                 | 63<br>63   | REC<br>REC   | 1   | 328<br>328  | 8: 7<br>17: 47   | 2.50<br>2.50   |                   |      |
| 17   | REC   | 2  | 338  | 13: 5  | 3.33  |                 | 64   | REC  | 1   | 328   | 8: 8   | 2.50   |                   |      |
|  |   |  |  |  |   |                 | 64<br>65   | REC<br>PEC   | 1   | 328   | 17: 48   | 2.50   |                   |      |
| 21   | RCE PRE   | 2 2 2  | 355<br>355   | 8: 6<br>17: 58   | 82.50<br>82.50  |                 | 65<br>65   | REC<br>REC   | 1   | 328<br>328  | 8: 9<br>17: 49   | 0.83<br>0.83   |                   |      |
| 21<br>21<br>21   | RCE PRE<br>RCE PRE                              | 2 2  | 360<br>360   | 8: 6<br>17: 58   | 82.50<br>82.50<br>82.50                                       |                 | 66<br>66   | REC<br>REC   | 1   | 328<br>328  | 8: 55<br>9: 50   | 2.50<br>2.50   |                   |      |
| 2  | RCE PRE   | 2  | 365  | 8: 6   | 82.50   |                 | 66<br>66   | REC<br>REC   | 1   | 328<br>328  | 16: 12<br>16: 52   | 2.50<br>2.50   |                   |      |
| 22   | RCE PRE   | 2  | 365<br>370   | 17: 58<br>8: 6   | 82.50<br>82.50  |                 | 67<br>67   | REC<br>REC   | 1   | 328<br>328  | 9: 51<br>16: 13  | 2.50<br>2.50   |                   |      |
| 23   | RCE PRE   | 2  | 370  | 17: 58   | 82.50<br>82.50  |                 | 68   | REC  | 1   | 328   | 8: 57  | 0.83   |                   |      |
| 24<br>24<br>24   | RCE PST<br>RCE PST                              | 1  | 355<br>355   | 8: 6<br>17: 58   | 82.50<br>82.50  |                 | 68<br>68<br>68   | REC<br>REC<br>REC  | 1   | 328<br>328<br>328   | 9: 52<br>10: 39<br>11: 59  | 0.83<br>0.83   |                   |      |
| 24<br>24   | RCE PST<br>RCE PST                              | 1  | 360<br>360   | 8: 6<br>17: 58   | 82.50<br>82.50  |                 | 68<br>68   | REC<br>REC   | 1 1 1   | 328<br>328<br>328   | 11: 59<br>15: 4<br>16: 14  | 0.83<br>0.83<br>0.83   |                   |      |
| 25<br>25   | RCE PST<br>RCE PST                              | 1  | 365<br>365   | 8: 6<br>17: 58   | 82.50<br>82.50  |                 | 68   | REC  | i   | 328   | 16: 54   | 0.83   |                   |      |
| 26   | RCE PST   |  | 370  | 8: 6   | 82.50   |                 | LICT OF  | THE OPPE   | ) pr 10   | ep on   | EACH COMMON  | IN Miceton   | H/I 224           | DEU  |
|  |   |  |  |  |   |                 |  |  |   |   |  | IN MISSION VL 1  | . i 3301          | NEV. |
| IUNE 2   | 23, 21:20                                       |  |  |  |   |                 | смв.   | MODE   | CAM.  | SOL   | HR.:MIN.   | **AZ.  |                   |      |
|  |   |  |  |  |   |                 | 69<br>69   | REC<br>REC   | 1   | 328<br>328  | 10: 37<br>11: 57   | 2.50<br>2.50   |                   |      |
| IST (  | OF THE ORDER                                    | OF U   | SE OF  | EACH COMMAN  | D IN MISSION VL 1 U   | J/L 330, REV. 8 | 69   | REC  | î   | 328   | 15: 2  | 2.50   |                   |      |
| смв.   |   |  |  |  |   |                 | -  |  | 1971  | 328   |  | 2.50   |                   |      |
|  | MODE  | CAM.   | SOL  | HR.:MIN.   | **AZ.   |                 | 70<br>70   | REC<br>REC   | 1   | 328   | 11: 58<br>15: 3  | 2.50   |                   |      |
| 26   | MODE<br>RCE PST                                 |  | \$0L<br>370  | HR.:MIN.   | **AZ.<br>82.50  |                 |  |  |   | 328<br>354<br>364   |  | 2.50<br>70.00<br>70.00   |                   |      |
| 26   |   |  |  |  |   |                 | 70<br>71<br>71<br>72   | REC CYC<br>REC CYC   | 1<br>1<br>1   | 328<br>354<br>364<br>359  | 15: 3<br>10: 0<br>10: 0  | 70.00<br>70.00<br>90.00  |                   |      |
| 26   |   |  |  |  |   |                 | 70<br>71<br>71   | REC CYC<br>REC CYC   | 1<br>1<br>1   | 328<br>354<br>364<br>359  | 15: 3<br>10: 0<br>10: 0  | 70.00<br>70.00   |                   |      |
| 26   |   |  |  |  |   |                 | 70<br>71<br>71<br>72<br>72   | REC CYC<br>REC CYC<br>REC CYC<br>REC CYC   | 1<br>1<br>1<br>1  | 328<br>354<br>364<br>359<br>369   | 15: 3<br>10: 0<br>10: 0<br>10: 0   | 70.00<br>70.00<br>90.00<br>90.00   |                   |      |
| 26   |   |  |  |  |   |                 | 70<br>71<br>71<br>72   | REC CYC<br>REC CYC   | 1 1 1   | 328<br>354<br>364<br>359  | 15: 3<br>10: 0<br>10: 0  | 70.00<br>70.00<br>90.00  |                   |      |
| 37   | RCE PST   | 1  | 370  | 17: 58<br>16: 38   | 82.50   |                 | 70<br>71<br>71<br>72<br>72<br>76<br>76   | REC CYC<br>REC CYC<br>REC CYC<br>REC CYC   | 1<br>1<br>1<br>1<br>1<br>2<br>2   | 328<br>354<br>364<br>359<br>369   | 15: 3 10: 0 10: 0 10: 0 10: 0  | 70.00<br>70.00<br>90.00<br>90.00   |                   |      |
| 37<br>37   | RCE PST   | 1  | 370<br>323<br>324  | 17: 58   | 82.50   |                 | 70<br>71<br>71<br>72<br>72<br>76<br>76   | REC CYC REC CYC REC CYC REC CYC REC CYC REC CYC  | 1<br>1<br>1<br>1<br>1<br>2<br>2   | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>330<br>359   | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 30   | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00   |                   |      |
| 37<br>37<br>38<br>39   | RCE PST  REC REC REC REC                        | 2 2 2  | 370<br>323<br>324<br>324<br>321  | 17: 58  16: 38 16: 38 8: 58 9: 32  | 2.50<br>2.50<br>2.50<br>2.50                                  |                 | 70<br>71<br>71<br>72<br>72<br>76<br>76<br>79<br>79   | REC CYC  | 1<br>1<br>1<br>1<br>1<br>2<br>2<br>2                                    | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>330<br>359<br>369  | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 10: 20  | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00   |                   |      |
| 37<br>37<br>38<br>39   | RCE PST  REC REC REC REC REC REC                | 2 2 1 1 1 1 1  | 370<br>323<br>324<br>324<br>321<br>322<br>323  | 17: 58  16: 38 16: 38 8: 58 9: 32 9: 32 9: 32  | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50          |                 | 70<br>71<br>71<br>72<br>72<br>76<br>76<br>77<br>79<br>79   | REC CYC  | 1<br>1<br>1<br>1<br>1<br>1<br>2<br>2<br>2<br>2                          | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>330<br>359   | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 14: 0 10: 20 10: 20 11: 52   | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>42.50  |                   |      |
| 37<br>37<br>38<br>39   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 2<br>2<br>1<br>1<br>1<br>1<br>1  | 370<br>323<br>324<br>324<br>321<br>322<br>323<br>325<br>326  | 17: 58  16: 38 16: 38 8: 58 9: 32 9: 32 9: 33 9: 34  | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70<br>71<br>71<br>72<br>72<br>76<br>76<br>79<br>79   | REC CYC  | 1<br>1<br>1<br>1<br>1<br>2<br>2<br>2                                    | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>339<br>359<br>369<br>324   | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 10: 20  | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00   |                   |      |
| 37<br>37<br>38<br>39<br>39<br>39<br>39<br>39<br>39   | REC         | 2 2 1 1 1 1 1 1 1  | 370<br>323<br>324<br>324<br>321<br>322<br>323<br>325<br>326<br>327<br>329<br>329   | 17: 58  16: 38 16: 38 9: 32 9: 32 9: 34 9: 34 9: 34 9: 34 9: 35  | 82.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50 |                 | 70 71 71 72 72 76 76 77 79 80 81 81 81 81 82   | REC CYC  | 1<br>1<br>1<br>1<br>1<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>1      | 328<br>354<br>364<br>359<br>369<br>354<br>369<br>339<br>369<br>324<br>339<br>359<br>369<br>359<br>359   | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 11: 20 11: 20 11: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20  | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00   |                   |      |
| 37<br>37<br>38<br>39<br>39<br>39<br>39<br>39<br>39<br>39<br>39<br>39   | REC         | 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | 378<br>323<br>324<br>324<br>321<br>322<br>323<br>325<br>327<br>326<br>327<br>329<br>338<br>331   | 17: 58  16: 38 16: 38 9: 32 9: 32 9: 33 9: 34 9: 34 9: 34 9: 35 9: 36  | 82.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50 |                 | 70 71 71 72 72 76 76 77 79 80 81 81 81 82 82   | REC CYC  | 1<br>1<br>1<br>1<br>1<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>1 | 328<br>354<br>364<br>359<br>369<br>354<br>359<br>369<br>324<br>339<br>359<br>369<br>359<br>369<br>359<br>369  | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 0 10: 20 10: 30 11: 20 11: 20 11: 20 10: 20 10: 20 10: 20  | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50   |                   |      |
| 37<br>37<br>38<br>39<br>339<br>339<br>339<br>339<br>40<br>40   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | 370<br>323<br>324<br>324<br>322<br>323<br>325<br>326<br>327<br>329<br>330<br>331<br>333<br>337   | 17: 58  16: 38 16: 38 9: 32 9: 32 9: 32 9: 34 9: 34 9: 34 9: 35 9: 36 9: 36  | 82.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50 |                 | 70 71 71 72 72 76 76 79 79 79 80 81 81 81 82 82 83 83  | REC CYC  | 2                                 | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>339<br>324<br>339<br>359<br>359<br>359<br>359<br>359<br>359<br>359<br>359<br>369                         | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 11: 20 11: 20 11: 20 11: 20 11: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 23 10: 23  | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50   |                   |      |
| 37<br>37<br>38<br>39<br>339<br>339<br>339<br>339<br>40   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | 323<br>324<br>324<br>322<br>323<br>325<br>326<br>327<br>329<br>331<br>333  | 17: 58  16: 38 16: 38 16: 38 9: 32 9: 32 9: 33 9: 34 9: 34 9: 34 9: 35 9: 36 9: 36   | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 79 79 79 80 81 81 81 82 82 83   | REC CYC  | 1<br>1<br>1<br>1<br>1<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>1<br>1 | 328<br>354<br>364<br>359<br>369<br>354<br>369<br>324<br>339<br>3369<br>324<br>339<br>3369<br>324<br>3369<br>359<br>354<br>359<br>359<br>369<br>359<br>369 | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 11: 20 11: 20 11: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20  | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50   |                   |      |
| 37<br>37<br>38<br>339<br>339<br>339<br>40<br>40<br>40<br>40  | RCE PST  REC REC REC REC REC REC REC REC REC RE | 2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1   | 370<br>323<br>324<br>324<br>322<br>323<br>325<br>326<br>327<br>329<br>330<br>331<br>333<br>339<br>340  | 16: 38 16: 38 16: 38 9: 32 9: 32 9: 33 9: 34 9: 34 9: 35 9: 36 9: 44 9: 44 9: 45   | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 77 79 79 80 81 81 82 82 82 83 83  | REC CYC  | 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                 | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>339<br>324<br>339<br>359<br>369<br>354<br>364<br>354<br>364<br>354<br>364                                | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 11: 20 11: 20 11: 20 11: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 23 10: 26   | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>12.50<br>15.00   |                   |      |
| 37<br>38<br>39<br>339<br>339<br>40<br>40<br>40<br>40<br>42   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | 370<br>323<br>324<br>324<br>321<br>322<br>323<br>325<br>327<br>330<br>331<br>333<br>337<br>340<br>329<br>340<br>329<br>329<br>339<br>340<br>329<br>329<br>339<br>329<br>329<br>329<br>329<br>329<br>329<br>329 | 17: 58  16: 38 16: 38 16: 38 9: 32 9: 32 9: 33 9: 34 9: 34 9: 35 9: 36 9: 44 9: 44 9: 44 9: 44 9: 45                                       | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 77 79 79 80 81 81 82 82 82 83 83  | REC CYC  | 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                 | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>339<br>324<br>339<br>359<br>369<br>354<br>364<br>354<br>364<br>354<br>364                                | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 11: 20 11: 20 11: 20 11: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 23 10: 26   | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>15.00   |                   |      |
| 37<br>38<br>339<br>339<br>339<br>40<br>40<br>40<br>40  | RCE PST  REC REC REC REC REC REC REC REC REC RE | 2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1   | 370<br>323<br>324<br>324<br>322<br>323<br>325<br>326<br>327<br>329<br>330<br>331<br>333<br>339<br>340  | 16: 38 16: 38 16: 38 9: 32 9: 32 9: 33 9: 34 9: 34 9: 35 9: 36 9: 44 9: 44 9: 45   | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 77 79 79 80 81 81 82 82 83 83 84 84   | REC CYC  | 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1                                 | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>330<br>359<br>369<br>324<br>339<br>359<br>369<br>354<br>364<br>364<br>354<br>364                         | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 11: 20 11: 20 11: 20 10 | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>22.50  |                   |      |
| 37<br>37<br>38<br>39<br>33<br>39<br>39<br>40<br>40<br>40<br>40<br>42<br>43   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | 370<br>323<br>324<br>324<br>321<br>322<br>323<br>325<br>327<br>338<br>339<br>349<br>349<br>324<br>324  | 17: 58  16: 38 16: 38 16: 38 9: 32 9: 32 9: 34 9: 34 9: 34 9: 35 9: 36 9: 44 9: 44 9: 44 9: 44 9: 44 9: 47                                 | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70<br>71<br>71<br>72<br>72<br>76<br>76<br>79<br>79<br>79<br>79<br>80<br>81<br>81<br>81<br>82<br>82<br>82<br>83<br>83<br>84 | REC CYC  | 2 2 2 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                 | 328<br>354<br>369<br>369<br>359<br>369<br>359<br>369<br>324<br>339<br>359<br>369<br>359<br>369<br>364<br>364<br>364                                       | 15: 3 18: 8 18: 8 18: 9 18: 9 18: 9 18: 9 18: 30 18: 30 18: 20   | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>21.50<br>22.50   |                   |      |
| 37<br>37<br>38<br>33<br>39<br>33<br>39<br>40<br>40<br>40<br>40<br>42<br>43<br>44   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 1<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>2<br>1<br>2<br>1<br>2<br>2<br>1<br>2<br>2<br>2<br>2<br>2<br>2<br>1<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2<br>2 | 370<br>323<br>324<br>324<br>321<br>322<br>323<br>325<br>327<br>330<br>331<br>337<br>338<br>339<br>349<br>340<br>324<br>324<br>324  | 17: 58  16: 38 16: 38 16: 38 9: 32 9: 32 9: 34 9: 34 9: 34 9: 35 9: 36 9: 44 9: 44 9: 44 9: 44 9: 47 13: 7                                 | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 79 79 80 81 81 81 82 82 83 83 84 84 84  | REC CYC  | 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1                                 | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>330<br>359<br>369<br>324<br>339<br>359<br>369<br>354<br>364<br>364<br>354<br>364                         | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 11: 20 11: 20 11: 20 11: 20 10 | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>22.50  |                   |      |
| 37<br>38<br>39<br>39<br>39<br>39<br>40<br>40<br>40<br>42<br>43<br>44<br>45   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 1<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>2<br>2<br>2<br>2   | 370<br>323<br>324<br>324<br>321<br>322<br>323<br>325<br>327<br>338<br>339<br>349<br>349<br>324<br>324<br>324<br>324<br>324   | 17: 58  16: 38 16: 38 16: 38 9: 32 9: 32 9: 34 9: 34 9: 34 9: 35 9: 36 9: 44 9: 44 9: 44 9: 44 9: 47 13: 7 13: 20 13: 22                   | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 79 79 80 81 81 81 82 82 83 83 84 84 84  | REC CYC  | 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 1 1 1 1 1                                 | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>330<br>359<br>369<br>324<br>339<br>359<br>369<br>354<br>364<br>364<br>354<br>364                         | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 11: 20 11: 20 11: 20 11: 20 10 | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>22.50  |                   |      |
| 37<br>38<br>39<br>39<br>39<br>39<br>39<br>39<br>39<br>39<br>40<br>40<br>40<br>44<br>45<br>46<br>47<br>48   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 1<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1  | 370<br>323<br>324<br>324<br>321<br>322<br>325<br>327<br>330<br>337<br>338<br>339<br>340<br>324<br>324<br>324<br>324<br>324<br>324<br>324<br>324  | 17: 58  16: 38 16: 38 16: 38 8: 58 9: 32 9: 33 9: 34 9: 34 9: 34 9: 34 9: 34 9: 36 13: 20 13: 22 13: 23 13: 18 11: 26 11: 32 19: 0         | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 76 79 79 80 81 81 81 82 82 83 84 84 84  | REC CYC  | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1   | 328<br>354<br>369<br>369<br>359<br>369<br>354<br>369<br>324<br>339<br>359<br>359<br>369<br>354<br>364<br>364<br>364<br>364                                | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 10: 20 11: 52 12: 0 11: 20 10 | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>22.50  | U4 33 <b>8,</b>   |      |
| 377 38 39993399 3399 3399 440 440 440 440 447 448 448 447 448 48   | RCE PST  REC REC REC REC REC REC REC REC REC RE | 1 2 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | 370<br>323<br>324<br>324<br>321<br>322<br>323<br>325<br>327<br>330<br>337<br>337<br>340<br>324<br>324<br>324<br>324<br>324<br>324<br>324<br>324  | 17: 58  16: 38 16: 38 16: 38 8: 58 9: 32 9: 34 9: 34 9: 34 9: 34 9: 34 9: 36 13: 7 13: 20 13: 22 13: 23 13: 18 11: 26 11: 32 10: 0 12: 24  | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 76 79 79 80 81 81 82 82 83 83 84 84 84  90 90  JUNE 33  | REC CYC REC CY | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                   | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>339<br>359<br>369<br>359<br>369<br>354<br>364<br>354<br>364<br>354<br>364                                | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 11: 20 11: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 25 10: 26 10: 26  | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>21.50<br>21.50<br>22.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21 | Ū/L 33 <b>0,</b>  |      |
| 37<br>38<br>39<br>39<br>39<br>39<br>39<br>39<br>39<br>39<br>39<br>40<br>40<br>40<br>40<br>40<br>41<br>42<br>43<br>44<br>45<br>46<br>47<br>47<br>48 | RCE PST  REC REC REC REC REC REC REC REC REC RE | 1<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>2<br>2<br>2<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1<br>1  | 370<br>323<br>324<br>324<br>321<br>322<br>325<br>327<br>330<br>337<br>338<br>339<br>340<br>324<br>324<br>324<br>324<br>324<br>324<br>324<br>324  | 17: 58  16: 38 16: 38 16: 38 8: 58 9: 32 9: 33 9: 34 9: 34 9: 34 9: 34 9: 34 9: 36 13: 20 13: 22 13: 23 13: 18 11: 26 11: 32 19: 0         | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 76 79 79 80 81 81 81 82 82 83 84 84 84  | REC CYC  | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                   | 328<br>354<br>369<br>369<br>359<br>369<br>354<br>369<br>324<br>339<br>359<br>359<br>369<br>354<br>364<br>364<br>364<br>364                                | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 10: 20 11: 52 12: 0 11: 20 10 | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>21.50<br>21.50<br>22.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21 | UA 33 <b>0,</b>   |      |
| 377 38 399 339 339 339 339 440 440 440 440 440 440 440 440 440 44  | RCE PST  REC REC REC REC REC REC REC REC REC RE | 1 2 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1  | 370<br>323<br>324<br>321<br>322<br>323<br>325<br>327<br>330<br>337<br>337<br>338<br>339<br>340<br>324<br>324<br>324<br>324<br>324<br>324<br>324<br>324   | 17: 58  16: 38 16: 38 16: 38 8: 58 9: 32 9: 34 9: 34 9: 34 9: 34 9: 34 9: 36 13: 20 13: 22 13: 23 13: 18 11: 26 11: 32 10: 0 12: 24 12: 53 | 2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50<br>2.50  |                 | 70 71 71 72 72 76 76 76 79 79 80 81 81 82 82 83 83 84 84 84  90 90  JUNE 33  | REC CYC REC CY | 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                   | 328<br>354<br>364<br>359<br>369<br>354<br>364<br>339<br>359<br>369<br>359<br>369<br>354<br>364<br>354<br>364<br>354<br>364                                | 15: 3 10: 0 10: 0 10: 0 10: 0 10: 0 10: 30 10: 30 10: 20 11: 20 11: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 20 10: 25 10: 26 10: 26  | 70.00<br>70.00<br>90.00<br>90.00<br>50.00<br>50.00<br>22.50<br>22.50<br>22.50<br>42.50<br>35.00<br>35.00<br>35.00<br>12.50<br>12.50<br>22.50<br>21.50<br>21.50<br>22.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21.50<br>21 | U/L 330,          |      |

INTERFACE AGE 73

when the data base was stored, who stored the data base and whether or not the data base was "cleaned" before storage.

The other chart, shown in Figure 12, tracks the progression of revision rolling, and revision creation. Whenever a change is made and rolled into the subsequent UPLINK the revision number is entered on the line of the UPLINK sol and the revision of the subsequent UPLINK at the time of the roll is entered on the line of that UPLINK. The line which is drawn on the outside of the revision numbers helps identify the progression.

## PAST HISTORY OF THE UPLINK GENERATION —TEARS AND CHUCKLES

As was stated earlier, the equipment has had an almost trouble-free history but that does not mean that problems have been absent during the extensive length of time the machines have been in use. The worst problem encountered had to do with interference from a silent 700 terminal located in the same room as one of the HP's and fed from the same power line. Using the silent 700 would sometimes cause the tape drives to take off on their own, once wiping out a whole program tape which was being changed and of which there was no copy yet. As anyone who has ever lost a program knows, it is infinitely worse to have to reenter changes in the middle of rewriting than it is to make the changes initially. The erasure caused a large measure of grief and a very urgent call to the HP repair service. The problem was never really solved, but rather was successfully circumvented by plugging the silent 700 into an alternate outlet. Less disastrous manifestations of the interference was that the plotter pen would shoot across the plotter bed without warning. This produced startled looks and laughter rather than disaster. A few times the calculator would go into a "I won't talk to anyone" state also as a result of the interference. The only solution in

this case was to punish the machine by shutting off its power until it forgot what it was up to.

Another problem which existed for a short while had to do with the plotter spring intended to lift the pen off the paper. Hewlett Packard had apparently switched spring suppliers and the springs which were being distributed would only last a few days under our heavy use before breaking. In utter desperation a piece of foam rubber was put in place of the spring, but the solution was hardly adequate since it prevented pen movement over the whole plotter area. The pen would be restricted by the foam rubber piece before reaching the edges.

The third problem encountered had to do with solenoids. One solenoid in the internal tape drive got stuck so that the tape drive would not function. Another had to be replaced in the plotter. The solenoid in the tape drive had only to be lubricated to get back into shape.

Considering that the machines have now been used for over a year and that six months that year were spent in operation of 24-hour days and 7-day weeks, one would be hard-pressed to justify any complaints.

The problems which cropped up were all severe, but only because of the high pressure situation under which they occurred. No problem was unresolved for more than a day and during that day one of the other HP's would carry the load normally carried by the machine which was down.

## PRESENT OTHER USES AND FUTURE USE OF THE COMPUTERS

Viking is now in the extended mission and UPLINKS occur with lower frequency than during the primary mission, but the Hewlett Packards are doing anything but resting. As time has gone on more and more people have realized what a convenient slave the machines

# THE 8700 COMPUTER/CONTROLLER

# An exceptional price on an <u>applications</u> <u>oriented</u> 6503 based micro-processor system featuring:

- 1K bytes RAM locations (512 bytes supplied)
- 1K bytes ROM locations (256 byte monitor included)
- 2 8 bit input ports
- 2 8 bit output ports (1 latched, 1 buffered)
- 24 key touch operated keypad (used by the monitor to allow entry and execution of user programs - also user definable.)
- 2 latched seven segment displays (used by monitor to display memory location and contents - easily user programmed)
- Optional cassette interface (\$22, 50) fits entirely on the processor board.

# THE IDEAL, LOW COST SOLUTION TO IMPLEMENTING ALL THOSE WILD COMPUTER BASED CONTROL SYSTEMS YOU'VE BEEN DREAMING OF!

PAIA software currently available or under development includes:

- Electronic music synthesizer interface.
- Home applications package including: Multi-zone fire & burglar alarm, real time clock, energy saving heat/air conditioning control, computer generated "door-bell".
- Model railroad controller
- More.....

### 8700 COMPUTER/CONTROLLER KIT ..... \$149.95

(requires 5v. @ 1.2A.; 12v. @ 150 ma.)

Shipped direct to you by PAIA (add \$3,00 postage & handling)

DETAILS ON PAIA KITS IN OUR FREE CATALOG ...... WRITE FOR IT TODAY!

.. OR PHONE OUR 24HR DEMO/ORDER LINE (405) 843-7396 BAC&MC ORDERS ALSO ACCEPTED.



Also available at FULL-LINE

Computer stores.



Dept. 7- F 1020 W. Wilshire Blvd. Oklahoma City, OK 73116

```
JUNE 23, 21:20
 INSERT CARDS FOR LISED TABLE CHANGES
 IN LSEQ CHANGE BASE OF VL 1 330 U/L-CAM-REV. 0 TO MAKE IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV. 8
TBL.CMD, 41.1.1.4.2.1.0.172.5,175.20
TBL.CMD, 49.4.1.8.2.1.0.27.5,35.10
TBL.CMD, 54.2.1.1.3.1.0.185,187.5.10
TBL.CMD, 55.2.1.2.3.1.0.185,187.5.10
TBL.CMD, 56.1.1.1.3.1.0.185.187.5.10
TBL.CMD, 57.1.1.2.3.1.0.185.187.5.10
TBL.CMD, 57.1.1.2.3.1.0.185.187.5.10
TBL.CMD, 58.0.1.1.3.1.0.185.187.5.10
TBL.CMD, 59.1.1.2.3.1.0.185.187.5.10
TBL.CMD, 48.3.1.8.2.1.0.150.155.0
TBL.CMD, 48.3.1.8.2.1.0.150.155.0
TBL.CMD, 48.3.1.8.2.1.0.152.5.162.5.-30
TBL.CMD, 40.0.1.4.2.1.0.247.5.250.20
*DLPAR,2
IMGRT,1,3,1620,2,1,19,*
 RUNUP, RESCAN, 1, 2
JUNE 23, 21:20
REMOVE CARDS FOR LSEG TABLE CHANGES.
IN LSEQ CHANGE BASE OF VL 1 330 U/L-CAM-REV. \theta TO MAKE IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV. \theta
INSERT CARDS FOR LISED MISET CHANGES
IN LSEO CHANGE BASE OF VL 1 330 U/L-CAM-FEV.
IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV.
                DCS, 338, **, **, **, 0, 2, **
               DCS,339,**,**,**,0,2,**
DCS,334,**,**,**,0,2,**
HIDD
HDD
                DCS,345,**,**,**,0,2,**
HILL
               DCS,344,**,**,**,0,2,**,RTI1
               HDD
               RCE, 360, 24, 44, 44, 94, 9, 2, **, RT11, RT14
              RCE, 368, **, **, **, 6, 2, **, RT11, RT14
RCE, 365, **, **, **, 0, 2, **, RT12, RT15
RCE, 365, **, **, **, 0, 2, **, RT12, RT15
ADD
ADD
               RCE,336,**,**,**,0,1,**
               RCE,338,**,**,**,0,1,**
RCE,339,**,**,**,0,1,**
RCE,341,**,**,0,1,**
HDD
ADD
               RCE,343,**,**,**,0,1,**,RTI1,PT12,FT13,FT14,PT15,RT10,RCE,344,**,**,**,0,1,**
ADD
ADD
               RCE, 345, +*, ++, **, 0, 1, +*
               RCE, 347, ***, ***, 0, 1, **, RTII
RCE, 370, **, **, **, 0, 2, **, RTIS, RTIA
HDD
ADD
               RCE, 370, **, **, **, 0, 2, **, RTIS, RTIE
ADD
               RCE,340,**,**,**,0,2,**,RTI1,RTI
DEL
               RCE, 340, **, **, **, 0, 2, **, RTI1, RTI4
RCE, 345, **, **, **, 0, 2, **, RTI2, RTI5
TIE!
DEL
               RCE,345,**,**,**,0,2,**,RTI2,RTI5
RCE,341,**,**,**,0,1,**
RCE,350,**,**,**,0,2,**,RTI3,RTI6
DEL
DF1
TIFL
               RCE,350,**,**,**,0,2,**,RTI3,RT16
               IMG,333,9,42,27,0,40,1,STOW
IMG,337,9,44,6,0,40,1,STOW
IMG,339,9,44,56,0,40,1,STOW
ODD
ADD
               IMG,340,9,45,21,0,40,1,810W
IMG,338,12,24,0,0,48,2,8TOW
IMG,339,12,0,0,0,81,2,8TOW
ADD
ADD
               IMG, 338, 9, 44, 31, 0, 40, 1, STOW

IMG, 359, 9, 15, 0, 1, 90, 1, STOW

IMG, 359, 10, 0, 0, 1, 72, 1, STOW

IMG, 359, 10, 20, 0, 1, 79, 2, STOW

IMG, 359, 11, 20, 0, 1, 81, 2, CRL 2, STOW

IMG, 364, 10, 0, 0, 1, 71, 1, STOW
ATID
HILL
ADD
HIDD
ADD
                IMG,364,10,20,0,1,82,1
IMG,364,10,23,0,1,83,1
ADD
                IMG,364,10,26,0,1,84,1,CAL2,STOW
               IMG, 364, 10, 26, 0, 1, 84, 1, FAL2, STON IMG, 364, 10, 30, 0, 1, 76, 2, CAL2, STON IMG, 337, 18, 41, 36, 0, 54, 2
IMG, 337, 18, 43, 0, 0, 55, 2
IMG, 337, 18, 45, 0, 0, 56, 2
IMG, 337, 19, 18, 47, 0, 0, 57, 2, STON IMG, 337, 19, 18, 0, 0, 59, 2
IMG, 337, 19, 26, 0, 0, 59, 2, STON IMG, 337, 19, 26, 0, 0, 59, 2, STON IMG, 369, 9, 15, 8, 1, 90, 1, STON IMG, 369, 9, 15, 8, 1, 90, 1, STON IMG, 369, 10, 20, 0, 1, 79, 2, STON IMG, 369, 10, 20, 0, 1, 79, 2, STON IMG, 369, 11, 20, 0, 1, 79, 2, STON IMG, 369, 11, 20, 0, 1, 79, 2, STON IMG, 338, 13, 5, 0, 0, 17, 2, STON IMG, 338, 13, 5, 0, 0, 17, 2, STON
ADD
RDD
HDD
ADD
ADD
ADD
ATITI
HDI
 ADD
 HDD
```

JUNE 23, 21:20

INSERT CARDS FOR LSEQ MSET CHANGES

IN LSEQ CHANGE BASE OF VL 1 330 U/L-CAM-REV. 8 B TO MAKE IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV.

```
IMG,339,9,15,0,1,90,1,STOW
            IMG,339,10,0,0,1,72,1,8TOW
IMG,339,10,20,0,1,79,2,8TOW
IMG,339,11,20,0,1,81,2,CAL2,8TOW
DEL
DEL
            IMG,344,10,0,0,1,71,1,5TOW
IMG,344,10,20,0,1,82,1
IMG,344,10,23,0,1,83,1
TIFI
DEL
            IMG,344,10,26,0,1,84,1,CAL2,STOW
IMG,344,10,38,0,1,76,2,CAL2,STOW
IMG,349,9,15,0,1,90,1,STOW
DEL
DEL
DEL
            IMG,349,10,0,0,1,72,1,8ТОЫ
IMG,349,10,20,0,1,79,2,8ТОЫ
DEL
DEL
            IMG,349,11,20,0,1,81,2,CAL2,STOW
DEL
```

JUNE 23, 21:20

REMOVE CARDS FOR LISER MISET CHANGES

IN LSEO CHANGE BASE OF VL 1 330 U/L SAB-REV. 0 TO MAKE IT THE CHANGE BASE OF VL 1 330 U/L-CAM-REV. 8

Figure 10.

### M6800HARDWARE/SOFTWARE

### • REAL TIME OPERATING SYSTEM

RT/68° is mask-programmed on a 6830 ROM that replaces the Mikbug\* ROM in your SWTPC 6800, Motorola D1 or D2 Evaluation Kit, etc. It is a powerful real time, multiprogramming operating system with many versatile system functions. RT/68°

operating system with inarry versatile system functions. K1766-can support up to 16 concurrent programs at 8 priority levels. MICROWARE has improved the Mikbug\* functions, added four more (Dump, Exec, Sys, Bkpt) and made tape load and punch program-usable. RT/68© is software and hardware com-patible with Mikbug\* and supports ACIA or PIA type interfaces. The comprehensive manual includes a complete source listing. RT/68MX ...... 55.00

### ANALOG INTERFACE SUBSYSTEM

### • SERIAL I/O INTERFACE

An RS-232 type serial interface card with full modem control capabilities (RTS, CTS, DCD). May also be used for interface with audio cassette systems. Plug compatible with SWTPC 6800 I/O huss

### THE MICROWARE CORPORATION P.O. BOX 954 Des Moines, Iowa 50304

Write or use reader service card for free brochure. Phone Orders (515) 279-9856 U.S. Orders Postpaid. BankAmericard and Mastercharge give all info on card. Mikbug\* is a trademark of Motorola, Inc.

**CIRCLE INQUIRY NO. 32** 

RITH

Revision Table for the tape on which the change file for Sol 330 Rev. 8 resides.

| Rev. No. | Sol | Date<br>Mo-Day-Year | Operator |
|----------|-----|---------------------|----------|
| 0        | 330 | 6- 1-77             | 5        |
| 1        | 330 | 6- 3-77             | 5        |
| 2        | 330 | 6- 5-77             | 2        |
| 3        | 330 | 6- 6-77             | 5        |
| 4        | 330 | 6- 7-77             | 5        |
| 5        | 330 | 6- 8-77             | 5        |
| 6        | 330 | 6- 8-77             | 5        |
| 7        | 330 | 6-12-77             | 2        |
| 8        | 330 | 6-17-77             | 2        |

Figure 11a.

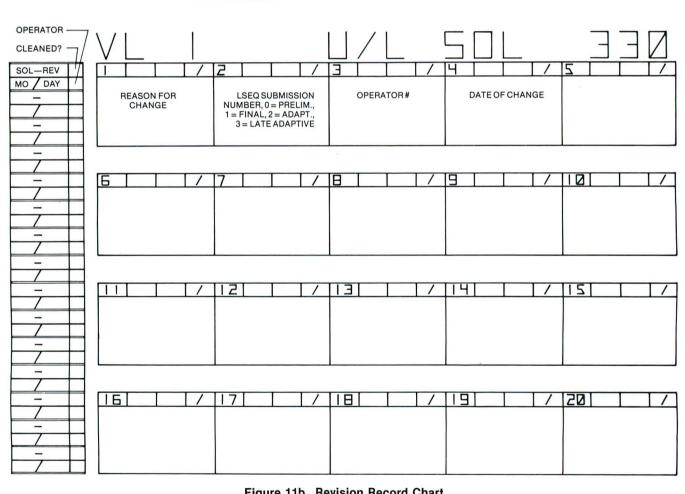
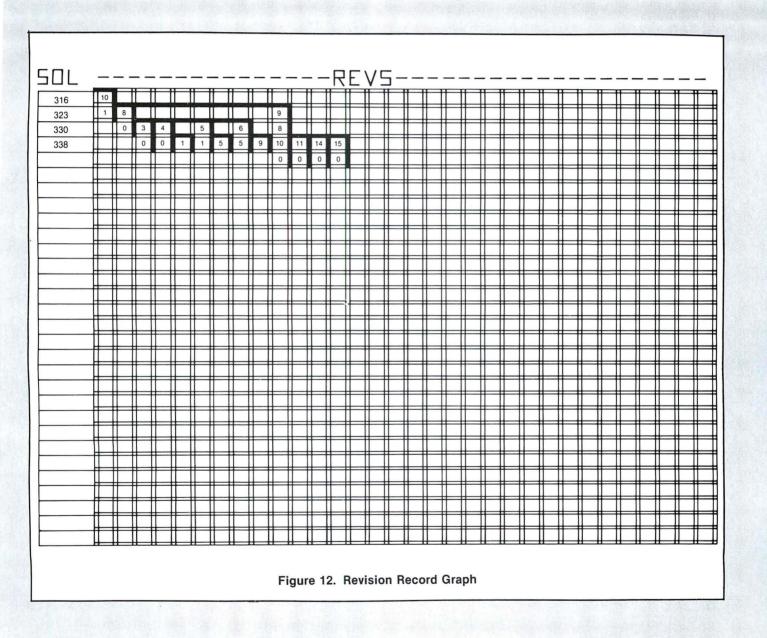


Figure 11b. Revision Record Chart

make. They are now extensively used to produce plots of various kinds which were formerly drawn by hand. The plots are used in the planning of a multitude of scheduling problems such as DOWNLINK opportunities, vacation schedules, major event plots, temperature plots (Martian), and Martian-to-Pacific time calendar plots, the plots used manually to track the bookkeeping and many many others. The rough draft of this article was written using the limited text editing functions made available by the data communications ROM which is normally used to interface the HP into other machines via a phone coupler.

A Viking Mission for 1984 is presently being investigated and it seems clear that even if these HP's have been gracefully retired by '84, other miniaturized computers will have taken their place in the operation of the mission. These HP's still have a planned year or two left during which they will be supporting the extended and then continuing mission. More tasks are dreamt up every day to simplify daily chores now carried out manually. As the Viking flight team is cut back every few weeks the HP's will be asked to help the remaining Vikings to carry out the job in more and more ways.



### **UPLINK/DOWNLINK LISTING**

### Figure 2.

```
UPLIN

10 CON PIT 196-10]-CIT 101-11]-ZIT 9]-ATT 242]-VIT 341

13 PRT-REL.1

15 DIM BET 253: DET73-FIT 100-23-010263-UT 53-ET 153-ATT 151

16 MRT U-ZEEK

25 FOR L-1

16 MRT U-ZEEK

25 FOR L-1

17 ST FOR L-1

18 ST FOR L-1

19 ST FO
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               GIS INPUT BS
G20 FBEILIJET THEN 645
G20 FARMINISTED SOS
G248-MICHINES SOS
G248-MICHINES SOS
G248-MICHINES SOS
G456 MICHIGANES MICHINES
G50 G456 MICHIGANES
G50 G456 MI
                                545 G4=VAL(BE)
550 IF G4<0 THEN 530
550 IF G4>02 THEN 530
560 G2=INT(G4)
560 G2=INT(G4)
570 INPUT BE
570 INPUT BE
580 G4=VAL(BE)
580 G4=VAL(BE)
580 G4=VAL(BE)
580 G4=VAL(BE)
580 IF G4>1 THEN 565
590 IF G4>1 THEN 565
590 G1=NT(G4)
600 C(V1+1-2]=G1-10*4+G2+10*12+G3
610 DISP START H2. IS: G4* CHRNGE
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                1325 INPUT G4

1230 IF G4:1000 OP G4:8001 THEN 265

1235 FOR I=1 TO Y1

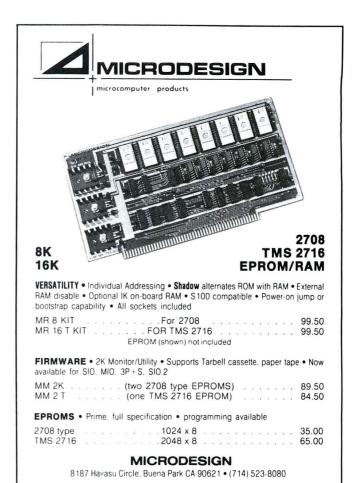
1240 IF CTI:6:18G4 THEN 1305

1245 G=CCI:11

1256 GOSUB 2015

1255 M1=02

1260 M2=G3
```



### CIRCLE INQUIRY NO. 28

NEW

FROM

7he Bare Board People™
THE 8K STATIC RAM BOARD™

BARE \$30

- \* WILL WORK WITH NO FRONT PANEL
- \* FULL DOCUMENTATION
- \* FULLY BUFFERED
- \* S100 DESIGN
- \* ADEQUATELY BYPASSED
- \* LOW POWER SCHOTTKY SUPPORT IC'S
- \* 500N SEC LOW POWER NEC 2102AL4'S

BARE BOARD \$30 KIT \$250 FULLY ASSEMBLED & TESTED \$295

SEE AT YOUR LOCAL COMPUTER SHOP OR WRITE FOR INFORMATION

WAMECO INC 3107 LANEVIEW DR SAN JOSE, CA. 95102



DEALER INQUIRIES INVITED

T

```
2655 Disp Tenter YOUR OPERATOR NO.":
2656 Disp Tills THE BATE AS NO. DRYLYS "!
2657 DISP TILL THE BATE AS NO. DRYLYS "!
2657 DISP TILL THE BATE AS NO. DRYLYS "!
2658 ETTEN
2658
                                2565 NEXT I
2570 IF ZC9]=1 THEN 2590
2575 FC186,6]=CC161,5]
2580 FC186,7]=CC161,5]
2580 FC186,7]=CC161,4]
2581 FOR I=1 TO 60
2582 EEEP
2582 SEEP
2583 WAIT 1000
2584 NEXT I
2585 GOTO 40
2590 D15P "ROLL REVISION2";
2595 INPUT B#
2600 IF B#I11]="N" THEN 2640
2605 GOSUB 2650
2610 LOAD DHTH 0.R
2615 FC186,7]=R(1]
2625 FC186,7]=R(1]
2625 ZC5]=R(1)
2630 ZC9]=0
2630 ZC9]=0
2635 GOTO 2705
2640 FC186,9]=0
2645 GOTO 40
2650 IF ZC4]>70 THEN 2675
```

# MICROCOMPUTERS 19" RACK S-100 BUS CARD CAGE

RUGGED 20 SLOTS EXTRUDED CHANNELS



BUS TERMINATION GROUND PLANE SOLDER MASK 12.25"H x 8"D

| ECT-100 CARD CAGE & MOTHER BOARD      | . KIT \$100 |
|---------------------------------------|-------------|
| ECT-100-F with 20 CONNECTORS & GUIDES | KIT \$200   |
| ECT-100-8080 CARD CAGE MICROCOMPUTER  | KIT \$320   |
| ECT-100-Z80 CARD CAGE MICROCOMPUTER   | .KIT \$420  |
| PS HEAVY DUTY 30A POWER SUPPLY        | .KIT \$100  |

### 10 SLOT TABLE TOP SYSTEMS

8080 or Z80 10 SLOT TABLE TOP MICRCOCOMPUTERS WRITE FOR SYSTEMS VARIATIONS & LOW PRICES



### CPU's

8080 or Z80 NEED NO FRONT PANEL JUMP ON RESET CIRCUIT

MOTHER BOARDS 10 SLOTS

20 SLOTS or 21 SLOTS

PROTOTPYING BOARD . . . . \$28 EXTENDER CARD . . . . . \$24

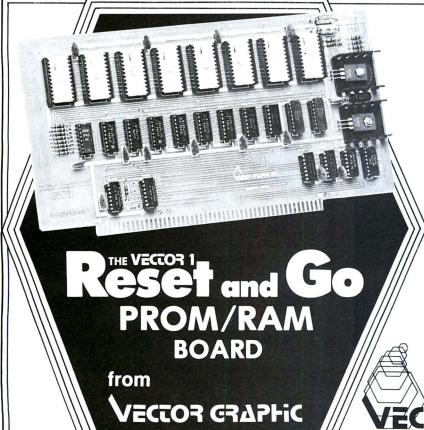
8K RAM ..... KIT \$295 16K RAM ..... KIT \$555

"See us at Atlantic City"

# ELECTRONIC CONTROL TECHNOLOGY

P.O. BOX 6, UNION, NEW JERSEY 07083 (201) 686-8080

**CIRCLE INQUIRY NO. 16** 



**PROM:** Space for 2K bytes, 1702A. Store bootstrap loaders and monitors.

RAM: 1K bytes, 2102LIPC, 450 ns, low power. NO NEED TO RELOCATE STACK WHEN ADDING MEMORY.

 $\mbox{\bf CIRCUITRY:}$  Replaces memory write logic on  $\mbox{\bf ALTAIR}^{\mbox{\scriptsize TM}}$  and Imsai front panels.

**REGULATORS:** Two regulators. No need for regulated power supply.

**JUMP-ON-RESET:** PROM program execution starts at any location in memory without interfering with programs in any other portion of memory.

S-100 BUS; +8 and -16 VDC; P/C BOARD SOLDER MASKED BOTH SIDES WITH PLATED THROUGH HOLES; ALL SOCKETS INCLUDED.

**OPTIONAL FIRMWARE:** 512 byte monitor for use with Tarbell tape interface on 2, 1702A PROMs.

 PROM/RAM KIT WITHOUT PROMS
 \$ 89

 + OPTION A - SIO Rev. 1 or 3 P + S
 \$129

 + OPTION B - 2 SIO (MITS)
 \$129

 + OPTION C - SIO 2 (IMSAI)
 \$129

 + OPTION D - Poly Video Interface (Includes Video Driver)
 \$159

California residents please add 6% tax.

IMMEDIATE DELIVERY FROM FACTORY OR YOUR LOCAL COMPUTER STORE

ECTOR GRAPHIC INC.

790 HAMPSHIRE ROAD, A & B • WESTLAKE VILLAGE, CALIFORNIA 91361 • (805) 497-0733

```
#385 COSUB 6125
#398 PRINT 'IMAGING DATA BASE PARAMETERS: (INCOMPLETE LIST)*
#395 PRINT 'IMAGING DATA BASE PARAMETERS: (INCOMPLETE LIST)*
#395 PRINT '1400 PRINT '
```



```
$460 GOSUB 6160
$455 31*0
$470 k1=0
$480 k1=0
```

```
5785 GOTO 5850
5800 G-CCC4+13
5805 M2-11G-100-M2
5810 M3-G-100-M2
5820 G-CCC4+21
5825 GOSUB 6105
5820 GOCCC4+21
5825 GOSUB 6105
5820 GOCCC4+21
5825 GOSUB 6105
5820 GOCCC4+21
5825 GOSUB 6105
5820 GOCCCC4+21
5825 GOSUB 6105
5826 FM: 12-330
5826 FM: 13-330
5826 FM: 11-330
5826 FM: 11-330
5826 FM: 11-330
5827 MEXT K2
5875 FM: 11
5826 FM: 11
5827 MEXT K2
5875 FM: 11
5826 FM: 11
5827 MEXT K2
5875 GOSUB 6105
5870 MEXT K2
5875 GOSUB 6105
5870 MEXT K2
5875 GOSUB 6105
5870 MEXT K2
5875 FM: 11
5826 FM: 11
5826 FM: 11
5827 MEXT K2
5875 GOSUB 6105
5870 MEXT K2
5870 MEXT
```



### cañada

### **Boards DO Something**



CL2400 Real Time Clock

\$98-Kit

\$135—Assembled

If your system needs to know what time it is, our CL2400 is the board for you. The present time in hours, minutes, and seconds is always available for input, and is continuously updated by the highly accurate 60 Hz power line frequency. Need periodic interrupts? The CL2400 can do that, too, at any of 6 rates. Reference manual with BASIC and assembly language software examples included.



#### PC3200

Power Control System

PC3232 \$299-Kit \$360-Assm. PC3216 \$189-Kit \$240—Assm. PC3202 \$39.50-Kit \$52—Assm.

If your system needs on/off control of lights, motors, appliances, etc., our PC3200 System components are for you. Control boards allow one I/O port to control 32 (PC3232) or 16 (PC3216) external Power Control Units, such as the PC3202 which controls 120 VAC loads to 400 Watts. Optically isolated, low voltage, current-limited control lines are standard in this growing product line.



(formerly comptek)

P.O. Box 516 La Canada, CA 91011 (213) 790-7957

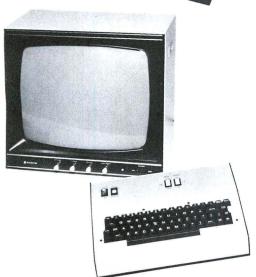
#### **CIRCLE INQUIRY NO. 6**

```
6145 PRINT " WARNING UNROLLED REVISION"
6150 GOTO 6175
6160 GUTPUT (15.6135) "SIP NO: VL";CC101,7];"-";CC101,5];" U/L-CAM-REV"CC101,4]
6165 IF Z[5]=0 THEN 6175
6170 PRINT "WARNING CHANGE IS NOT FINAL"
6175 FOR II=1 TO M7
6180 PRINT
6180 RETURN
6190 RETURN
```

```
7015 MEXT 17
7017 12112-1
7010 PETTION
7017 12112-1
7010 PETTION
7017 12112-1
7010 PETTION
7017 12112-1
7010 PETTION
7010
```

# Either,...Or a choice in ACT-IV





The Affordable Computer Terminal—model IV

Standard features include:

DISPLAY: Upper and descending lower case characters
24 lines of 80 characters
Auto-scrolling

KEYBOARD: Full ASCII with cursor controls and auto-repeating cursor movements, 'space,' and 'period.'

TRANSMISSION MODES: Character by character or "page" mode in which trailing spaces and blank lines are not transmitted.

SPECIAL FUNCTIONS: relative and absolute cursor addressing, home up, erase to end of line, erase to end of screen, fixed tabs, and display control characters

TRUE EDITING: in PAGE mode, the user can insert or delete characters on any line and insert or delete lines on the page. Preexisting data on the screen is appropriately rearranged by the ACT-IV processor to accommodate the user's command.

DATA RATE: 300 to 19200 baud

The ACT-IV is available in two configurations. The ACT-IVa comes in a compact (briefcase compatible) cabinet without video monitor for \$550.

The ACT-IVb comes complete with a 12" monitor and numeric keypad in a single enclosure for \$800.

Optional available features: separate printer port (110-9600 baud) \$50. Custom assignment of the special features to the set of control codes \$50.

MICRO-TERM has a complete line of video terminals beginning at \$400 and available from discriminating computer stores.

### MICRO TERM INC.

P.O. BOX 9387 ST. LOUIS, MO. 63117 (314) 645-3656

"Come by and see us at Booth 205 in Atlantic City"

```
1137 IF H330 THEN 1140
1138 B1=(2.5E+05)+(1+INT(B1/1.92E+05))
1139 GOTO 1145
1140 B1=B1+M7+275200
1145 B2=B2+B1
1149 B1=H77+17.5
1150 B1=(H7-H6)+3413*((250+15750+H3)+k1)+H1+(P[100+1]+P[100+2]/10)+P[100+3]/100
1151 IF J1)1 THEN 1155
1152 B1=B1/(250+H3+15750)
1155 B3=B3+B1
1160 IF M1=83 THEN 1230
1165 IF S1=1 THEN 1185
1178 S4=1
1179 S4
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             REASON: "@$[2,25]
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    1288 B3=B2-44-40-INI-OLD H3-1 THEN 1310
1296 G070 1335
1296 G070 1335
1296 G070 1325
1296 G070 1225
1300 EF Jai-AND H3=1 THEN 1320
1300 EF Jai-AND H3=0 THEN 1320
1300 EF Jai-AND H3=0 THEN 1320
1300 FRITT "HARRING: RCE IMAGE WITH HIGH DATA RATE CMD."
1310 FRITT "HARRING: RCE IMAGE WITH LOW DATA RATE CMD."
1312 EF JAI-DATA-H6-3-413-WI THEN 1325
1327 J3=1
1328 FR FILO RCH-H6-3-413-WI THEN 1325
1329 FR J1-10 RC J3-6.5 THEN 1340
1329 FR J1-10 RC J3-6.5 THEN 1340
1320 FR J1-15 THEN 1355
1320 FR J1-15 THEN 1355
1350 MEXT IS
1350 FR J1-1 THEN 1355
1350 MEXT IS
1360 FR J1-1 THEN 1355
1350 MEXT IS
1360 FR J1-1 THEN 1355
1370 FR J1-1 "NO PICTURES FOUND WITH DESIRED CHARACTERISTICS."
1375 FR J1-1 THEN 1595
1400 FR J1-1 THEN 1595
1410 MF-4
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         TOTAL BITS THIS MODE: ":
```

```
1745 F(1,J)=G2
1759 NEXT J
1760 FOR J=4 TO 5
1761 FOR J=8 TO 20
1762 MS=J=21+1-19
1763 IF MS):144 THEN 1775
1764 FOR K=4 TO 5
1765 IF P(MS):149 THEN 1769
1766 M=155+6+P(MS,3)+P(MS,K)
1767 K1=12+K-3
1768 F(K1-J)=P(M4,6)
1769 NEXT J
1770 NEXT J
1771 NEXT J
1775 FOR J=6 TO 11
1770 NEXT J
17
```

```
2045 NEXT I
2050 GOTO 2135
2055 H44-92
2056 N5-1
2060 IF 1):76 AND I(180 THEN 2075
2070 M5-1
2070 FOR J-6 TO 11
2080 FOR J-6 TO 11
2080 FOR J-1 TO 48
2085 IF LEFIL:J) THEN 2125
2090 H1-97-HINT(CI-1):/6)-J-8
2095 IF H1 186 THEN 2135
2125 MEXT I
2130 NEXT I
2131 NEXT I
2145 NEXT I
2145 GOSUB 2275
2146 FIRTT
2145 NEXT I
2146 IF N:50 OR N(4 THEN 2150
2146 IF N:50 OR N(4 THEN 2150
2146 IF N:50 OR N(4 THEN 2150
2147 OUTPUT (15: 2185) "LIST OF THE ORDER OF USE OF EACH COMMEND IN MISSION";
2148 IS DESCRIPTION OF THE ORDER OF USE OF EACH COMMEND IN MISSION";
2150 IF 2175 OUTPUT (15: 2185) "LIST OF THE ORDER OF USE OF EACH COMMEND IN MISSION";
2160 GOSUB 1690
2175 OUTPUT (15: 2185) "LIST OF THE ORDER OF USE OF EACH COMMEND IN MISSION";
2180 OUTPUT (15: 2185) "LIST OF THE ORDER OF USE OF EACH COMMEND IN MISSION";
2181 FORMAT F2.0-F4.0-F3.0
2190 IF PIESCO STORMAT F2.0-F4.0-F3.0
2191 IF PIESCO STORMAT F2.0-F4.0-F3.0
2192 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2200 PIEST COMMENT F2.0-F4.0-F3.0
2210 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2211 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2212 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2213 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2214 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2215 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2216 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2217 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2218 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2219 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2210 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2210 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2211 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2212 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2213 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2214 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2215 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2216 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2217 PIEST "LARRING: UNROLLED REVISION IN MISSION."
2218 PIEST "LARRING: UNROLLED REVISION IN MISSION."
221
```

# ■ Field Engineers ■ Software Specialists

■ Sales Professionals The industry's leading state-of-the-art minicomputer manufacturer needs state-of-the-art people in openings nationwide.

Digital Equipment Corporation is where the action is for career oriented, fast moving Field Engineers, Software Specialists and Sales Professionals. We're looking for people with the following backgrounds in these areas:

### Field Engineers experienced in one or more of these areas:

- CPU troubleshooting and repair
- Core and semiconductor memory
- Peripheral fault isolation and diagnostics

### **Software Specialists** experienced in one or more of these areas:

- Real time, event-driven application
- Operating system design and modification
- RSX 11, RSTS/E, TOPS 10
- Business application design
- · Cobol, Assembly, Fortran

# **Sales Professionals** solid track record of success in computer sales in any of the following:

• Industrial-Telecommunications-Graphic arts-Large Computers -Laboratory-Education-Banking-Insurance Terminals-Brokerage-Commercial

Career opportunities and job satisfaction can be yours by taking a step in the right direction. Send your resume today to: Bob Eldridge, Dept. K8, Digital Equipment Corporation, 122-I Parker Street, Maynard, Mass. 01754. We are an equal opportunity employer, m/f.



"See us at the Holiday Inn, Atlantic City. Our representatives will be interviewing August 27 & 28."



### THE FIRST REAL ALTERNATIVE TO DISK STORAGE FOR THE S-100 BUS

MICRO DESIGNS introduces the Model 100 and Model 200 Digital Cassette Mass Storage Systems. A high speed seek function and formatted data structure make these systems practical alternatives to floppy disks. These design features allow quick read and write access to individual records without altering other data on tape.

### Our systems offer:

- Complete file management package on cassette with each unit.
- Random access capability 4096 individually accessible records on each cassette.
- File copy capability on the dual drive Model 200.
- High data capacity ½ megabyte per cassette.
- High speed seek to individual records at 120 in/sec. Worst case access less than 30 seconds.
- Hardware CRC for soft error recovery Soft error rate less than 1 in 10<sup>8</sup> bits.
- Bootstrap loader in onboard PROM.

The MICRO DESIGNS Models 100 and 200 are fully assembled and rigorously tested at the factory. They come ready for immediate use.

MODEL 100 . . . . \$600 MODEL 200 . . . . \$875

Contact your local computer store for a demonstration or additional information.

Or write or call us directly.

MICRO DESIGNS, INC. 499 Embarcadero Oakland, CA 94606 (415) 465-1861

**CIRCLE INQUIRY NO. 29** 

```
3875 IF ZCT7/-1.5 THEN 3128
3888 GOT271-1
3888 GOT3 3115
3888 GOT3 3115
3898 GOT3 3116
3898 GOT3 3116
3898 GOT3 3128
3898 GOT3 3129
3898 GOT3
```

```
3770 IF H2>0.5 THEN 3810
3775 G1=C(H3:6]-3168
3780 UI 1]-INT(G1/6)
3785 H7=1
3790 GOSUB 3980
3795 H7=6
3800 PRINT ";D$[38,46];B$[1,Y1]
3805 GOTO 3820
3815 GOTO 3820
3820 UI 1]-G1-6+UI 1]+1
3825 IF H1>0.5 THEN 3920
3830 UI 2]-C(H3:1]
3845 UI 3]-C(H3:2]+C(H3:3]/10
3840 UI 4]-C(H3:4]
3850 UI 3]-C(H3:2]+C(H3:4)
3850 UI 3]-C(H3:4)
3860 UI 4]-C(H3:4)
3870 GOSUB 3980
3872 IF H1>6
3871 IF H1>6
3872 IF H1>6
3875 IF H1>7
3870 D3-D3+3
3870 D3-D3+3
3870 D3-D3+3
3870 D3-D3+3
3970 PRINT "TO ";D$[9,16];B$[1,Y1]
3910 D3-D3+4
3915 RETURN
3920 UI 2]-R(H4:1]
3925 UI 3]-R(H4:4)
3930 UI 4]-R(H4:4)
3931 UI 5]-R(H4:5)
```



# Less Bread, More Box.



New, complete Breadboarding/Interfacing Station.
Only \$241.50!

We took our economy Breadbox IV kit and did a complete design number on it...to add accessories and give you far more hardware for the buck.

For example: It plugs directly into your Altair/Imsai buss without special adapters . . . Gives you almost 3,000 connections for breadboarding . . . Power supplies (+5 & +/- 15V) built in . . . Available in kit or assembled format. All that for just \$241.50 each in kit form.

And to top it off, monitor the buss with LED or 7 segment displays, add an LR-6/K LED indicator outboard – 4 individual LED's with driving circuits (\$10.00 each). And LR-4/K seven segment display outboard with driver/decoder (\$19.00 each).

So bug out to your local computer store now and save substantial bread on this E&L deal. Or write us for the store nearest you.

\*Suggested resale price (U.S.A.). **Dealer inquiries invited.** 



### **E&L INSTRUMENTS, INC.**

61 First Street, Derby, Conn. 06418 (203) 735-8774 Telex No. 96 3536

"See us at Booth 133 in Atlantic City"



# 16K Static RAM

- IMSAI/Altair/Z-80 compatible
- 100% tested IC's
- 4K low-power static RAMs; no refresh
- Each 4K addressable to any 4K slot
- Fully buffered bus
- Low-power Schottky TTL's
- Gold-plated contacts; solder mask
- Low-profile sockets for all chips

### Kit \$365°° Assembled \$450°°

MasterCharge and BankAmericard telephone orders welcome. All orders shipped on a first-come basis. No C.O.D.'s. California residents add 6% sales tax. Orders shipped prepaid.

# **ANDENBERG DATA PRODUCTS**

P.O. BOX 2507 === SANTA MARIA, CA 93454 805/937-7951

### **CIRCLE INQUIRY NO. 56**

```
CIRCLE INQUIRY NO. 56

4100 NEXT K1
4105 B5(Y1,Y1)=","
4110 NEXT I1
4115 V1=Y1-1
4115 Y1=Y1-1
4120 RETURN
4125 B5(Y1,Y1+1)="0,"
4120 RETURN
4125 B5(Y1,Y1+1)="0,"
4130 Y1=Y1+1
4135 GOTO 4110
4140 H7=1
4145 IF H1=1 RND H2=1 THEN 4210
4150 IF H1=1 RND H2=0 THEN 4270
4155 IF CCH3:11+CCH3:21/10=CCH3:71+CCH3:81/10 THEN 4275
4155 IF CCH3:11+CCH3:21/10=CCH3:71+CCH3:81/10 THEN 4275
4156 UCI]=CCH3:11+CCH3:21/10=CCH3:71+CCH3:81/10 THEN 4275
4160 UCI]=CCH3:11+CCH3:21/10=CCH3:71+CCH3:81/10 THEN 4275
4160 UCI]=CCH3:11+CCH3:21/10=RCH4:71+RCH4:81/10 THEN 4275
4170 IF RENIT "TO "iD#C60:67]:B#[1,Y1]
4180 D9=D9+2
4185 FRINT
4200 PRINT
4200 PRINT
4200 PRINT
4200 PRINT
4201 IF RCH4:11+RCH4:21/10=RCH4:71+RCH4:81/10 THEN 4275
4215 UCI]=RCH4:11+RCH4:21/10
4210 IF RCH4:11+RCH4:21/10
4220 GOND 3980
4225 IF H1>0.5 THEN 4250
4230 PRINT "FROM "iD#C60:67]:B#[1,Y1]
4235 PRINT
4245 GOTO 4275
4240 PRINT
4245 GOTO 4275
4250 PRINT "FROM "iD#C60:67]:B#[1,Y1]
4255 PRINT
4260 D9=D9+3
4265 IF CCH3:11+CCH3:21/10#RCH4:11+RCH4:21/10 THEN 4215
4276 IF CCH3:11+CCH3:21/10#RCH4:11+RCH4:21/10 THEN 4215
4276 IF CCH3:11+CCH3:21/10#RCH4:11+RCH4:21/10 THEN 4215
4275 IF H1=1 RND H2=1 THEN 4340
4280 IF H1=1 RND H2=1 THEN 4395
4285 IF CCH3:31=CCH3:91 THEN 4400
4290 UCI]=CCH3:31-1COH3
4300 IF H1>0.5 THEN 4320
4301 D9=D9+1
4290 UC13=C(H8,3)/100
4295 GOSUB 3980
4300 IF H1>0.5 THEN 4320
4305 FRINT "iD#(47,59);B#(1,Y1)
4310 D=D+1
4315 GOTO 4400
4320 PRINT "TO ":D#(47,59);B#(1,Y1)
4325 PRINT
4325 PRINT
4330 D=D9+3
4335 GOTO 4400
4345 UC13=R(H4,3)/100
4350 GOSUB 3980
4355 IF RH4,3]/100
4355 IF H1>0.5 THEN 4375
4360 PRINT ";D#(47,59);B#(1,Y1)
4365 D9=D9+1
4370 GOTO 4400
4375 PRINT "FROM ";D#(47,59);B#(1,Y1)
4380 PRINT
4380 PSINT
4480 PSINT
```

```
### 170 LET 10 CCL(#) ***

### 17 CCL(#) ***

### 1
                   5095 B$[Y|+1,Y|+5]="DUST,"

5108 Y1=Y1+5

5108 Y1=Y1-1

5110 RETURN

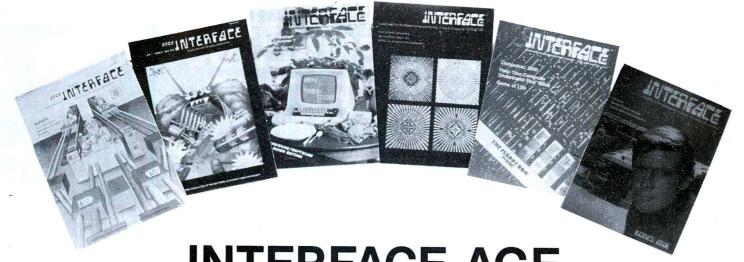
5115 H7=1

5117 GOSUB 3980

5119 B$[Y|+1,Y|+10]=",-+,-+,--,-

5121 H7=2

5123 U[1]=0
```



INTERFACE AGE

# **BACK ISSUES**

## **Available in Limited Quantities**

Vol. 1, Issue 5, APRIL 1976

Vol. 1, Issue 6, MAY 1976 \*

Vol. 1, Issue 9, AUGUST 1976

**Vol. 1, Issue 11, OCTOBER 1976** 

Vol. 1, Issue 12, NOVEMBER 1976

Vol. 2, Issue 1, DECEMBER 1976 \*

Vol. 2, Issue 2, JANUARY 1977

Vol. 2, Issue 3, FEBRUARY 1977

Vol. 2, Issue 5, APRIL 1977

Vol. 2, Issue 4, MARCH 1977

Vol. 2, Issue 6, MAY 1977

Vol. 2, Issue 7, JUNE 1977

Vol. 2, Issue 8, JULY 1977

TOTAL ENCLOSED \$\_

\*Limited

| lame (rint)    |     |       | Address . |                 | Ci  | ty    |       | State      |     | Zip   |      |
|----------------|-----|-------|-----------|-----------------|-----|-------|-------|------------|-----|-------|------|
| lease send me: |     |       |           |                 |     |       |       |            |     |       |      |
| Issue          | Qty | Price | Total     | Issue           | Qty | Price | Total | Issue      | Qty | Price | Tota |
| APRIL 1976     |     | 2.25* |           | DECEMBER 1976** |     | 2.25* |       | APRIL 1977 |     | 2.25* |      |
| MAY 1976**     |     | 2.25* |           | JANUARY 1976    |     | 2.25* |       | MAY 1977   |     | 2.25* |      |
| AUGUST 1976    |     | 2.25* |           | FEBRUARY 1977   |     | 2.25* |       | JUNE 1977  |     | 2.50* |      |
| OCTOBER 1976   |     | 2.25* |           | MARCH 1977      |     | 2.25* |       | JULY 1977  |     | 2.50* |      |
| NOVEMBER 1976  |     | 2.25* |           |                 |     |       |       | 8          | 1   |       |      |

\*Price includes 50¢ for postage and handling.

Available in very limited quantities.

Exp. Date Sig.

AUGUST 1977 INTERFACE AGE 91



- ★ MONTH AFTER MONTH LOOK TO INTERFACE AGE MAGAZINE FOR THE LATEST INFORMATION ON THE DYNAMIC WORLD OF PERSONAL COMPUTING.
- Use your personal computer for auto repair, work bench controller, teaching machine, central information bank and design test center.
- Control your small business with your own real-time accounting and inventory control system.
- Set your computer to turn sprinklers on and off, manage a household security system, feed your dog.
- Establish a recipe bank to plan daily meals and generate its own shopping list.
- Evaluate the stock market, set up gambling and probability programs. Evaluate odds on sporting events and horse racing.
- \* READ INTERFACE AGE FOR THE LATEST ON NEW PRODUCT INFORMATION AND TECHNICAL BREAKTHROUGHS.
- May's issue included inside the FLOPPY ROM<sup>TM</sup> a vinyl record which is played on a conventional phonograph to enter this month's program in your computer.

\* ARTICLES RANGE FROM THE FUNDAMENTALS OF COMPUTERS TO LANGUAGES AND SYSTEM DESIGN. APPLICATIONS INCLUDE BOTH PROFESSIONAL AND NON-TECHNICAL.

| _ |   |                   |                 |
|---|---|-------------------|-----------------|
|   | * ORDER YOUR SUBSCRIPTION NOW!  12 Monthly Issues: \$10 U.S., \$12 Canada/Mexico.       | , \$18 Internatio | onal            |
|   | Name  |                   |                 |
|   | Address   |                   |                 |
|   | City  |                   |                 |
|   | ☐ Check or M.O. (U.S. Funds drawn on U.S. Bank)   | ☐ Visa Card       | ☐ Master Charge |
|   | Acct No.  | E                 | xp. Date        |
|   | Make checks payable to: INTERFACE AGE MAG.<br>P.O. Box 1234, Cerritos, California 90701 | AZINE             |                 |
|   |   |                   |                 |

92 INTERFACE AGE AUGUST 1977

```
5367 GOSUB 3980
5369 BSI(Y1+1,Y1+1G)=",***,***,***,**
5371 H7=2
5373 U(1)=2
5373 U(1)=8
5375 U(2)=R[L,3]
5377 Y1=Y1+10
5377 Y1=Y1+10
5379 GOSUB 3985
5385 Y1=Y1+1
5390 BSI(Y1+1,Y1+3)="**,"
5400 GOTO 5155
5400 RSINT SEMOVE CARDS FOR LSEQ TABLE CHANGES."
5410 M7=4
5410 GOSUB 5525
5443 PRINT "REMOVE CARDS FOR LSEQ MSET CHANGES"
5435 M7=4
5440 GOSUB 5525
5445 GOSUB 5525
5446 GOSUB 5525
5447 PRINT "INSERT CARDS FOR LSEQ MSET CHANGES"
5455 PRINT "INSERT CARDS FOR LSEQ MSET CHANGES"
5475 PRINT "INSERT CARDS FOR LSEQ MSET CHANGES"
5485 M7=4
5490 GOSUB 5525
   3485 M7=4
3496 GOSUB 5525
3497 PRINT "INSERT CARDS FOR LSEO TABLE CHANGES"
3598 PRINT "INSERT CARDS FOR LSEO TABLE CHANGES"
3590 PRINT "INSERT CARDS FOR LSEO TABLE CHANGES"
3590 PRINT "INSERT CARDS FOR LSEO CHANGE BASE OF VL":CC101,7];RC101,5];" UVL-CAM-";
3510 OUTPUT (15,5521)" REV.,"RC101,4];" TO MAKE"
3515 OUTPUT (15,5521)" UVL-CAM-REV.,";CC101,4];
3516 OUTPUT (15,5521)" UVL-CAM-REV.,";CC101,4];
3517 OWNAT 28,3,6
3518 OWNAT 28,3
3518 OWNAT 28,3,6
3518 OWNAT 28,3

                          5490 GOSUB 5525
5495 PRINT "INSERT CARDS FOR LSEQ TABLE CHANGES"
```

# SC/MP USERS

EXPAND YOUR SC/MP KIT CAPABILITIES
(Or your SC/MP Kit with Keyboard)

#### WITH OUR MOTHERBOARD KIT



Plug your SC/MP kit into our MOTHERBOARD KIT and have a development system capable of addressing 64,000 bytes of memory. The following fully buffered I/O lines are also provided: 8 bit data I/O, BRDS, BWDS, BADS, BFLGO, BLFG1, BLFG2, BSOUT, READ, FETCH, DELAY, HALT, MEMRDY, RUN, ENCPU, BSIN,

ASENSE, and BSENSE. The MOTHERBOARD KIT assigns addresses 0 to FFF for the system. The user then has available addresses 1000 to FFFF. The MOTHERBOARD KIT provides one expanded output. Requires modification to SC/MP kit.

Also available is our MOTHERBOARD EXTENDER KIT. It includes a plug (to be installed on MOTHERBOARD) and a circuit board which provides the capability of adding 5 additional plugs (additional plugs must be ordered separately). This board may also be used as a vertical extender board for card accessibility during trouble shooting.

MOTHERBOARD KIT MOTHERBOARD EXTENDER KIT 72 pin plug (for use with Extender Kit) \$99.00 each \$25.00 each \$ 5.00 each

Delivery 4 to 6 weeks — Add \$2.00 postage and handling. California residents add 6% sales tax. Send orders to:

#### **BW WARD ENTERPRISES**

P.O. BOX 8122, LONG BEACH, CALIFORNIA 90808

Write for further information.

**CIRCLE INQUIRY NO. 3** 

## PLUG INTO OUR

QUIET MOTHER.

# BARE \*35

- \* 12 SLOT MOTHER BOARD
- \* S100 DESIGN
- \* FULL GROUND PLANE ON ONE SIDE
- \* RC NETWORK TERMINATION ON EVERY LINE EXCEPT POWER AND GROUND
- \* KLUGE AREA
- \* STRONG 1/16" THICK DOUBLE SIDED BOARD

BARE BOARD \$35 KIT \$85 FULLY ASSEMBLED & TESTED \$100

SEE AT YOUR LOCAL COMPUTER SHOP OR WRITE FOR INFORMATION

WAMECO INC 3107 LANEVIEW DR SAN JOSE, CA. 95102



DEALER INQUIRIES INVITED

. . . .



# STAR-SHIP SIMULATION Part I of III

by Roger C. Garrett\*

#### INTRODUCTION

Simulation is probably one of the most fascinating fields within the computer sciences. Being able to fly a lunar module to the surface of the moon or detonate nuclear warheads to determine the fallout patterns over some specific area of the earth through the use of a computer simulation, without any of the dangers inherent in actual tests, can be a rewarding experience.

An associate of mine had the privilege of working on a fighter-bomber simulation in which two fully equipped cockpits were mounted on a dynamic test bed allowing them to be tilted and vibrated in order to simulate the actual yaw, pitch, roll and G-forces of a real aircraft. From within the cockpit the pilot was presented with a computer-controlled 360-degree field of view. The computer could present the pilot with just about any tactical situation, from landing under emergency conditions to dog-fights with the pilot in the other simulator.

A simulation need not be an extensive piece of hardware. However, software is often a major portion of the total system. What I intend to do in this article is describe the methods used in designing and implementing software simulation and by doing so, familiarize the

reader with the techniques by which any large programming task may be implemented. While some hobbyists may be content with simple programming and game playing, there are many who have greater ambitions. What the reader can learn from this article is how to attack a program which on the surface appears insurmountable but when approached in a straightforward, structured manner can be quite easily implemented.

The most important question to answer is, "How do you actually simulate something?" There are two steps. First you must determine the attributes (or characteristics) which sufficiently define the object or phenomenon which you are simulating. This means describing it to its fullest extent.

The first step is to define the the relationships of these attributes to themselves and to the environment. For example, we can choose a star, our Sun, and describe it. It is located at a particular point in space, it is 2.7 million Km across, it has a mass of 2\*10133 grams, it is travelling at 32 Km per second towards Antares, and it gives off radiation. We now choose attributes which delimit these observations. We call its particular point in space its location. Its speed and direction is its velocity vector; its weight we call mass, and so on. Then we can accurately describe any star simply by defining the values of these attributes.

## **DEFINITION**

Simulation: The representation of physical systems and phenomena by computers, models, or other equipment; e.g. an imitative type of data processing in which an automatic computer is used as a model of some entity, e.g. a chemical process. When information enters the computer to represent the factors of a process, the computer produces information that represents the results of the process, and the processing done by the computer represents the process itself.<sup>1</sup>

<sup>&</sup>lt;sup>1</sup>Computer Dictionary and Handbook by Charles J. Sippl and Charles P. Sippl, 1972, New York. Howard W. Sams & Co., Inc.

<sup>&</sup>lt;sup>2\*</sup>President, Rhode Island Computer Hobbyist Club (RICH).



The second step is to define the relationships of these attributes with themselves and with the attributes of the other objects and phenomena in the simulation. For the star these would include physical relationships such as F = M \* A, the inverse square law of radiation. etc., and simulation relationships such as what happens when the star is hit by another star or when the radiated energy is depleted.

This can be a difficult part of the simulation process. In some cases where we do not know the relationships we will have to make (hopefully educated) guesses. In a task such as the STAR SHIP simulation (to be described fully in subsequent issues) many of the relationships are simply fiction and therefore up to the programmer's imagination. Does anyone really know what happens

when a photon torpedo hits a star?

But in many simulations we try accurately to represent physical phenomena. When we are uncertain or have no basis for a representation we make a guess. After we implement the guess and run the simulation we might be able to judge whether the results are reasonable, and, if not, to change the approach to the problem. In this way a simulation can help us examine several approaches to a given problem without actually having to do the physical experiments.

#### **DESIGNING A SIMULATION**

The steps in producing any piece of software are the same whether it be for a small program to generate random numbers or an extensive simulation system. You must (1) define the overall objective, (2) identify the major functions, (3) define the objectives of each of the major functions, (4) define the interface between the major functions, (5) define the logic flow of the major functions, (6) code the logic flow, and (7) implement and test the logic flow.

While these constitute the major steps in producing software they are not necessarily discrete steps. Although the general flow of work is from top to bottom (from number 1 to number 7) there is often an overlapping of progress. Parts 1 through 4 would probably be done together since the definitions required often expect the predefinition of some other part. It is a recursive type of work where one part is tentatively defined, some other part is defined based on the first, and then the first is redefined based on the further understanding of the second part. Though this may sound confusing, it actually is not. It means simply that the project must be viewed as a whole, and that understanding must be established for all of the parts working together as well as each part working individually. The more time that is spent on preparation the less time is needed for debugging.

#### **DEFINE THE OVERALL OBJECTIVE**

It should be obvious that an overall objective must be clearly understood before undertaking any task; yet all too often this step is overlooked. Many programmers begin with coding (writing the program), having only a vague idea of what the program is expected to do. In this trial-and-error method much time is wasted in needless testing, code-writing, and subsequent re-writing. Having a clearly specified objective is of utmost importance.

#### **IDENTIFY THE MAJOR FUNCTIONS**

The next task is to define the major functions. This can be done in several ways. A large programming task may employ several software and hardware specialists so that a joint effort by all-probably a common meeting -might be required to talk over the objectives. Each member may have expertise in a particular phase of the simulation or may have been assigned to research some aspect. In the joint meeting each one can express his ideas and then defend them as the others pick it apart to find flaws.

Most programmers will not have access to a software team and must rely upon their own resources and ingenuity. That, however, should not stop them from taking on a large task. They should simply partition the task into workable pieces so that when it comes to the point of defining the logic flow the functions can be tackled one at a time.

A "major function," then, can be thought of as "a portion or section of the entire system which accomplishes some predefined goal and which is logically distinct from the other functions." For example, in a chess playing program there might be several main functions which include displaying the game board, accepting player moves, piece position evaluation, and so on.

#### DEFINE THE OBJECTIVES OF EACH OF THE **MAJOR FUNCTIONS**

This portion of the system design is closely related to the previous one. Obviously when attempting to identify the major functions you must have a good idea of the objectives of each. This part simply helps to further clarify the task by writing down exactly what you want to accomplish.

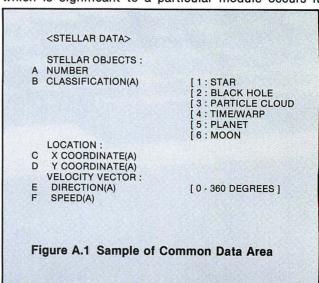
This may involve subdividing the major functions into smaller sub-functions. A piece position evaluation function for a chess-playing program may contain subfunctions to evaluate starting positions, middle-game positions, and ending-game positions. The main objective here is to section the task into logical workable pieces so that each one can be handled individually and the programmer does not have to keep track of the entire system at one time.

I want to introduce here a new term: module. I will generally use module interchangeably with function. A module is easily thought of as a subroutine and, indeed, is often implemented as such. I use module simply because I am used to it. Just as a computer may be made up of several hardware modules, e.g. the CPU board, memory modules, I/O modules, so software is made up of functional modules.

#### DEFINE THE INTERFACE BETWEEN THE MAJOR FUNCTIONS

An interface must be defined between the several major modules. The interface is the method by which the modules exchange information.

A simple method of transferring information is through an area of main (or offline) memory specified as a COMMON area. This means that all modules have access to it. Each module continually (i.e. every time it gets executed) monitors the variables in common and when a change which is significant to a particular module occurs it



takes the appropriate action. If the programming language being used is BASIC then the problem is simple since all variables are accessible to every portion of the program, subroutines included. In order for subroutines (modules) to have access to variables defined in other subroutines or the main routine when using FORTRAN the programmer must explicitly put them into a common area. This is easily done with the COMMON statement. Every language has some means by which all modules may have access to a common data area.

Defining the interface not only means defining the method of interchange but also explicitly naming the variables which will reside in the common area and their meanings. One suggested method is to compile a list of the variables, their names, their meanings, and their range of values, grouped logically. They might also be included in a chart showing which modules can read the variable values and which modules can alter (or write) the values into the variables. (See Figures A.1 and A.2)

An alternative interfacing method is including a module which routes messages from one module to another. In this form whenever a module needs some information it signals the message module by setting a flag (setting some variable to 1) which then requests the desired information from the appropriate module and, upon receiving it, sends it over to the requesting module. This form of information exchange is an extremely complicated one and not generally suitable for implementation on personal computers so I will not discuss it further. The COMMON area concept is much easier to implement and understand. After the logic flow has been determined the interface can further be defined, since you will have a better idea of the types of data being used.

## DEFINE THE LOGIC FLOW OF THE MAJOR FUNCTIONS

It is always advisable to design the logic flow in a structured manner. I always suggest that a program first be written using only comment statements (REMARK statements in BASIC). There should be no actual code written yet, until the entire program is defined. Working this way eliminates much of the debugging and subsequent re-writing.

The constructions employed in structured programming are fairly self-explanatory and can be understood merely by looking over a program which utilizes it. (See the bibliography of structured programming books at the end of this article and Figure A.3).

When structured programming is first introduced to most people who have been programming for some time, they reject the concepts as too constraining. They enjoy the freedom of programming techniques acquired over the years. It appears awkward to forego this freedom for the apparent rigidness of structured programming. But consider this: originally the only language available was machine code, writing lines of 0's and 1's. Some were fortunate enough to work in octal. This was the ultimate in programming freedom. However, it was tedious and even medium-sized programming tasks took on gargantuan proportions. It was very difficult to keep track of everything. Then the assembly language was developed allowing symbolic referencing and mnemonic substitutions for binary OP codes. The software was a little more structured. It was easier to read and comments could be added to the code to clarify the functional objectives. Next came high-level languages that employed English-like structures and the task of developing software became even easier. The writer no longer had to worry about registers, memory allocation, or how I/O was accomplished.

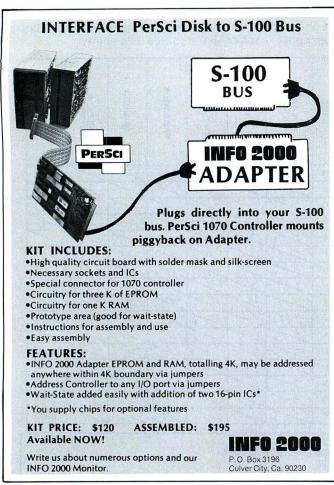
With each advancement the programmer lost some of what he had previously called "programming freedom." But by doing so, and adopting the new "constraints"

Figure A.2 Sample of an Access Chart

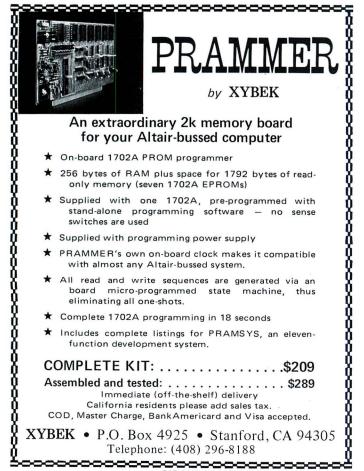
The upper left of each square signifies write-ability, the lower right of each square signifies read-ability.

| lower right of each square signifies read-ability. |         |             |                |            |          |                    |                |
|--|---------|-------------|----------------|------------|----------|--------------------|----------------|
| VARIABLE   | COMMAND | ENGINEERING | COMMUNICATIONS | NAVIGATION | SCIENCES | MEDICAL<br>SYSTEMS | HELM           |
| Α  | ++      | /           | +              |            |          |                    |                |
| В  | ++      |             | +              |            |          | /                  | /              |
| С  | + +     | +           | +              |            |          |                    |                |
| D  | ++      | +           | +              |            |          | +                  |                |
| Е  | ++      | +           | +              |            |          | +                  |                |
| F  | + +     |             |                | ++         |          | +                  | /              |
| G  | ++      | + +         |                | + +        |          | +                  |                |
| Н  | + +     |             | +              | + +        |          | + +                | $\sim$         |
| 1  | ++      |             | +              | + +        |          | + +                |                |
| J  | ++      |             | +              |            |          | +                  | $\overline{}$  |
| К  | ++      | +           | +              |            | +        |                    | +              |
| L  | +++     | + +         |                |            | +        |                    | <del>- +</del> |
| М  | + +     | +           |                |            | +        |                    |                |
| N<br>O   | -       |             |                |            | +        |                    | $\leftarrow$   |
| P  | -       |             |                | +          |          |                    | <del>- +</del> |
|  | +       |             |                | +          |          |                    | ++             |

| IF (CONDITION) (STATEMENT SEQUENCE) ENDIF   | TYPE 1  |
|---|---------|
| IF (CONDITION) (STATEMENT SEQUENCE 1) ELSE (COMMENT) (STATEMENT SEQUENCE 2) ENDIF   | TYPE 2  |
| IF (CONDITION 1) (STATEMENT SEQUENCE 1) ORIF (CONDITION 2) (STATEMENT SEQUENCE 2) ORIF (CONDITION 3) (STATEMENT SEQUENCE 3) ORIF (CONDITION N) (STATEMENT SEQUENCE N) ENDIF   | TYPE 3  |
| IF (CONDITION 1) (STATEMENT SEQUENCE 1) ORIF (CONDITION 2) (STATEMENT SEQUENCE 2) ORIF (CONDITION 3) (STATEMENT SEQUENCE 3) ORIF (CONDITION N) (STATEMENT SEQUENCE N) ELSE (COMMENT) (STATEMENT SEQUENCE N + 1) ENDIF | TYPE 3  |
| REPEAT (STATEMENT SEQUENCE) UNTIL (CONDITION)   | TYPE 4  |
| WHILE (CONDITION) (STATEMENT SEQUENCE) ENDWHILE   | TYPE 5  |
| FOR I = N TO M STEP R (STATEMENT SEQUENCE) ENDFOR   | TYPE 6  |
| Figure A.3 Structured Programming Construc  | t Chart |



**CIRCLE INQUIRY NO. 23** 



IF CODE = 0: IF C<>0 THEN GOTO 40 SET INITIALIZATION FLAG. 20 **GOTO 100** 30 ORIF CODE = 1: 40 IF C<>1 THEN GOTO 80 CLEAR INITIALIZATION FLAG. 50 F1 = 060 **GO TO 100** ELSE CODE IS BAD : 70 REM PRINT 'BAD CODE' SO NOTIFY OPERATOR. 80 90 REM FNDIF **GOSUB 1000** GET INPUT FROM OPERATOR; 100 <PRINT SQUARES OF 1 TO 10> 110 REM FOR I = 1 TO 10 PRINT SQUARE OF I. 120 FOR I = 1 TO 10 PRINT 1<sup>2</sup> 130 140 **NEXT I ENDFOR** 

Figure A.4 Example of Implementing Structured Code in BASIC

(rules of the language), he was able to develop larger and more complex programs. He could concentrate more on the logic of the task and less on how to implement it. This is also true of structured programming, even though it is more a set of techniques than a language in itself. It does impose constraints, but it allows the programmer to develop larger and hence more powerful software. It frees him from the confusion and drudgery of software and lets him devote more time to thinking and planning, which is the heart of programming.

There are other benefits, too. The logic flow of a structured program is easy to follow. Compare the logic definitions and their associated flow charts of Figure A.3 with those of some of the programs currently being published in hobbyist magazines. It should be obvious that the structured one is the easiest to read. Flow charts are often not needed with structured programs except perhaps to give the reader a general overview of the whole system. While no computer language is "self-documenting" (APL included) the techniques of structured programming makes any software more readable, and that is a great benefit. Someday, somebody is going to look over that program you wrote so long ago, either simply to understand it or to update it. The readability will be very important then.

#### CODE THE LOGIC FLOW

At some point early in the design of the system the decision should be made as to which programming language is to be used for implementation. Knowing the instruction repertoire that will be available often has an effect on the way the logic flow is developed. For most hobbyists the choices are limited to BASIC and the assembly languages of their computers, but for others their choices may be quite varied. There are many tradeoffs to be considered. If speed of execution is of utmost importance then an assembly language such as 6502

FOR I = 1, 10 WRITE (1,10)A FORMAT('HELLO THERE') 10 **ENDFOR** X = 0REPEAT X = X + .1UNTIL (X.Q.1) Q = 100WHILE (Q.GT.7) Q = Q - .3ENDWHILE IF (CODE.EQ.1) ORIF (CODE.EQ.2) ORIF (CODE.EQ.3) ELSE ENDIF Figure A.5 FORTRAN Example: Before Preprocessing

CIRCLE INQUIRY NO. 61

DO 99999 I = 1,10 WRITE (1,10)A 10 FORMAT('HELLO THERE') 99999 CONTINUE X = 099998 CONTINUE X = X + .1IF(.NOT.(X.EQ.1)) GOTO 99998 Q = 100**GOTO 99997** 99996 CONTINUE Q = Q - .399997 CONTINUE IF(Q.GT.7) GOTO 99996 IF(.NOT.(CODE.EQ.1)) GOTO 99995 **GOTO 99994** 99995 CONTINUE IF(.NOT.(CODE.EQ.2)) GOTO 99993 H = 98**GOTO 99994** 99993 CONTINUE IF(.NOT.(CODE.EQ.3)) GOTO 99992 J = 4**GOTO 99994** 99992 CONTINUE K = 099994 CONTINUE END Figure A.6 FORTRAN Example: After Preprocessing

ASM would be best. But the coding will probably take longer and generally be more tedious. If ease of programming is important, then a high-level language such as BASIC or FORTRAN might be a good choice. If understood that it may run slower than its assembly language counterpart. The trade-offs and their respective importance is up to the programmer.

When the logic has been thoroughly defined, the actual code of the selected language can be written. It is unfortunate that no structured programming language has yet been developed, although there are several languages that allow certain constructions such as IF/ELSE/ENDIF. It is the programmer's job to develop the code that executes the functions of each structured programming construct. This is quite simple for most languages. As an example, look at the BASIC program of Figure A.4. (Double quotes signify the beginning of the comment field, allowed in some versions of BASIC).

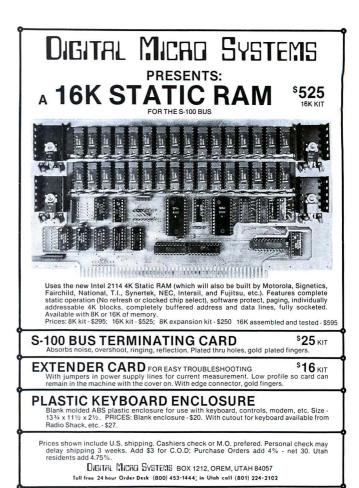
The structured comments make it clear what the executable statements are accomplishing. Without them, understanding the function of any section of code becomes a task in itself. A programmer wants to program, not to be an interpreter of confusing code.

Some programmers are fortunate enough to have access to a piece of software called a "structured programming preprocessor." It allows the programmer to write source code using structured constructs not normally allowed in a particular language. The source code is then used as input to the preprocessor which interprets it and produces as output a new source code listing with each of the structured constructs converted into its corresponding code in the selected language. Figures A.5 and A.6 are an example of a FORTRAN program before and after preprocessing (FORTRAN normally does not allow structured constructs).

#### IMPLEMENT AND TEST THE LOGIC FLOW

All too often the only test procedures followed is "Run it till it fails, then debug." The more advisable method is to plan a set of test procedures while the software is being developed (Steps 1 to 5), when you know exactly what each section of the code should produce. This may include such things as a sample input with known results — best used in numerically processed data — or a scenario in the case of a simulator.

Including trace functions in the code is a very good practice. A trace function is one or more lines of code



#### **CIRCLE INQUIRY NO. 15**

that prints out the values of critical variables at certain points during the execution of the program. It may include messages such as "GOT TO THE FIRST SUBROUTINE OK WITH K=7" to let the operator follow the logic flow during the run. When an unexpected value or message turns up or the logic flow doesn't follow the expected path, the programmer will know exactly where in the program to look for the error. After all of the problems are resolved, the trace functions are removed for the final program version.

Some programming systems include a built-in trace function which usually prints out more information than is really necessary. I suggest that the program developer utilize his own tracing methods rather than try to wade through the massive printouts produced by the standard trace functions. He can include only what is sufficient to test his program and not have to cope with so many extraneous trace outputs.

Next month I will begin the description of a fairly extensive simulation project which should serve as an example of the principles discussed here. Also discussed will be the use and importance of a scenario in conjunction with simulation techniques.

#### **BIBLIOGRAPHY**

- Dahl, O.J., E.W. Dijkstra, and C.A.R. Hoare, Structured Programming,, Prentice-Hall 1972.
- McGowan, C.L. and J.R. Kelly, Top-Down Structured Programming Techniques, Petrocelli/Charter, 1975.
- Yourdon, E. and L.L. Constantine, Structured Design, Yourdon Incorporated 1975.
- Wirth, N., Systematic Programming: An Introduction, Prentice-Hall 1973.

INTERFACE AGE 99

# Puzzled About Computers?

# Data Dynamics Technology has a library of answers . . .

Computers & Their Uses By William H. Desmonde. 427 pages, \$16.80

The main purpose of this book is to give the reader a glimpse into the essential characteristics of digital data processing machines and their uses. It does not offer specialized instructions in design, programming, and applications, but explains the concepts basic to all of these areas by means of simplified examples. Order No. PH5498-5, cloth.

Advanced BASIC
By James S. Coan. 192 pages, \$6.95
This book is for those who want to extend their

expertise with BASIC and offers advance techniques and applications, including coordinate geometry, area, sequences and desires, polynominals, graphing, simulations and games.

Order No. HAY5855-1, paper.

An Introduction to Microcomputers: Volume 1, Basic Concepts By Adam Osborne. 000 pages, \$7.50

This book covers the hardware and software concepts required for the intermediate technician and hobbyist's needs.

Order No. OSB2001, paper.

APL: A Short Course
By Sandra Pakin and the Staff of
Computer Innovations.

157 pages, \$13.10

This book was developed to meet the needs of Computer Innovations customers to learn APL, A Programming Language, and the use of APL defined functions quickly and easily. Order No. PH8877-7, paper.

5

COBOL for Beginners By Thomas Worth. 369 pages, \$12.10

This book presents a basic, easy-tounderstand introduction to COBOL programming language. It is intended for classroom use as the central text in a one or two-semester course. It can also be used by persons who must teach themselves COBOL. Order No. PH9378-2, paper.

Digital Trouble Shooting: Practical Digital Theory & Troubleshooting Tips By Richard E. Gasperini. 180 pages, \$9.95

New digital products are presenting as big a challenge to service personnel as did the change from vacuum tubes to transistors. The thrust of this new Handbook is practical digital theory and troubleshooting, so it is ideal for all engineers and technicians.

Order No. HAY5708-3, paper.

Digital Experiments: Workbook of IC Experiments

By Richard E. Gasperini. 177 pages, \$8.95

This workbook offers experiments for the hobbyist's and professional's delight. A bevy of experiments and thought provoking applications to stimulate any designer's torrid ambitions. Order No. HAY5713-X. paper.

The BASIC Workbook: Creative Techniques for Beginning Programmers By Kenneth E. Schoman, Jr.

117 pages, \$4.25

A "workbook" in every sense, BASIC Workbook takes an active problem-solving ap-

proach to BASIC that demands both creativity and discipline from students. It is an introduction to the language, in that only 29 keywords are used, but students quickly discover how much they can do with this limited repertoire—How many problems can be solved and how many workable algorithms can be constructed. Order No. HAY5104-2, paper.

Organizing & Documenting Data Processing Information By Thomas R. Gildersleeve.

152 pages, \$7.95

A dynamic text showing how to write sharp, precise DP documents that command attention. The book reveals five steps in information organization that will instill clarity and conciseness into all your DP writing.

Order No. HAY5739-3, paper.

Digital/Logic Electronics Handbook. By Samuel D. Stearns. 308 pages, \$6.95

Learn digital electronics, number systems, logic, and boolean algebra while studying modern digital circuits for a lock, calculator, thermometer, multimeter, and interval timer, in this down-to-earth book on logic and digital electronics . . without the mass of formulas and equations found in many books, but with practical info.

Order No. TB774, paper.

Display Electronics
By Ken Tracton. 252 pages, \$5.95
A fascinating collection of optoelectronic circuits and projects using light-emitting diodes, infrared-emitting diodes, photodiodes, phototransistors, light-activated SCRs, and a host of other exotic display devices.

INTERFACE AGE BINDERS
AND SLIP CASES

Collecting magazines can bring headaches — not to mention dust, ripped pages and misplaced copies. If you use back issues of INTERFACE AGE as reference material, nothing

is more annoying than taking time to find mislaid copies. Data Dynamics Technology is now offer-

ing deluxe binders and slip cases which will place each back issue of INTERFACE AGE at your

| Order No. PH8877-7, paper. | Workbook takes an active problem-solving ap- | Order No. TB861, paper.                  |
|----------------------------|--|--|
| DATA DYNAMICS TECHNOLOG    |  | INTERFAC                                 |
| Address                    |  | AND S  Collecting magazines              |
| City                       | StateZip                                     | <ul> <li>to mention dust, rip</li> </ul> |
| Please send me:            |  | copies. If you                           |

Shipping & Handling Charges
Binders and Slip Cases\$1.00 ea. U.S., \$1.50 ea. Foreign
Code Cards \$.25 ea. U.S., \$.50 ea. Foreign
Books \$.50 ea. U.S., \$1.00 ea. Foreign

| TOTAL ORDERA                          |  |
|---------------------------------------|--|
| TOTAL ORDER \$ SHIPPING & HANDLING \$ |  |
| TAY                                   |  |

Total

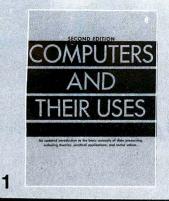
| Т | OTAL ENG   | LOSED \$_ |     |    |       |      |  |
|---|------------|-----------|-----|----|-------|------|--|
|   | California | Residents | add | 6% | Sales | Tax. |  |
|   | D-4-       | Cia       |     |    |       |      |  |

You may photocopy this page if you wish to keep your INTERFACE AGE intact. Please allow six weeks for delivery.

fingertips. Each binder and slip case is constructed of a handsome blue vinyl with INTERFACE AGE stamped in gold foil on the front cover and spine. These rugged binders and slip cases can hold 12 issues each and will protect them for years.

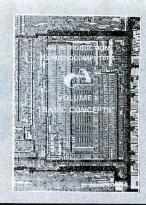
For Bulk Store Quantities contact: MicroMedia Marketing,(213) 681 – 0685

□ M/C#



Dasic

Special Company of the Compan



Basic Digital Electronics —
Understanding Number Systems,
Boolean Algebra, & Logic Circuits.
By Ray Ryan. 210 pages, \$4.95
An extremely easy-to-understand "self-

An extremely easy-to-understand "self-learning" guidebook to digital circuits, logic applications, number codes and systems — and a sensible comparison of the various logic features.

Order No. TB728, paper.



Build Your Own Working Robot By David L. Heiserman.

234 pages, \$5.95

Here are complete instructions—plans, schematics, logic circuits, and wiring diagrams—for building Buster, the most lovable (and mischievous) mechanical pet in the world! He'll serve you coffee or bring you the morning papers. He'll forage for his own "food" and scream when he can't find it. His "curiosity" will get him into one plight after another, but Buster has the capacity to get himself out of trouble just as easily as he got into it!

Order No. TB841, paper.



TYCHON's 8080 Octal and Hex Code Cards

The code cards are a slide rule-like aid for programming and debugging 8080 software. Both cards contain all the standard mnemonics and either their corresponding octal or hex codes. The pocket size cards are color-coded and are 6.5 by 3 inches (16 by 8 cm) with instructions provided. The back of both cards is printed with an ASCII code chart for all 128 characters plus the 8080's status word and register pair codes. \$2.95 each.

Allow 3 to 4 weeks delivery.

Basic BASIC: An Introduction to Computer Programming in BASIC Language By James S. Coan. 256 pages, \$7.95 Order No. HAY5872-1, paper.

Some Common BASIC Programs By Lon Poole & Mary Borchers. 192 pages, \$7.50

Order No. OSB21002, paper.

6800 Programming For Logic Design By Adam Osborne. 310 pages, \$7.50 Order No. OSB5001, paper.

Master Handbook of 1001 Practical Electronic Circuits Edited by Kendall Webster Sessions. 601 pages, \$9.95

Order No. TB800, paper.

Microprocessor Basics By Michael Elphick. 215 pages, \$9.95 Order No. HAY5763-6, paper.

I/O Design: Data Management In Operating Systems By D. E. Freeman, and O. R. Perry. 374 pages, \$17.50 Order No. HAY5789-X, cloth.

Fundamentals and Applications of Digital Logic Circuits
By Sol Libes. 192 pages, \$6.95
Order No. HAY5505-6, paper.

Minicomputers: Structure and Programming By T. G. Lewis, and J. W. Doerr. 282 pages, \$12.95

Order No. HAY5642-7, cloth.
Digital Signal Analysis

By Samuel D. Stearns. 280 pages, \$19.95 Order No. HAY5828-4, cloth.

Programming Microprocessors By M. W. McMurran. 279 pages, \$6.95 Order No. TB985, paper.

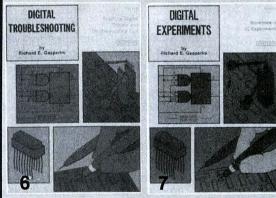
Microprocessor/Microprogramming Handbook By Brice Ward. 297 pages, \$6.95 Order No. TB785, paper.

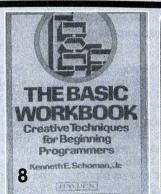
Master Handbook of Digital Logic Applications By William L. Hunter. 390 pages, \$7.95 Order No. TB874, paper.



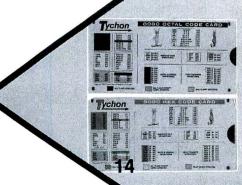
3

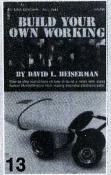


















# **BENTON HARBOR BUS: ANOTHER APPROACH**

by Thomas C. Yeager
Chief Engineer, Computer Products HEATH COMPANY

With the new introduction of H8 and a modified bus structure unique only to Heath Company, many questions are created both from a potential customer standpoint and engineering standpoint. We contacted Mr. Yeager to author this article so that all our readers could understand the philosophy behind the Benton Harbor Bus and why the deviation from the standard S-100 Bus structure.

Why a new bus? This question will be asked a thousand times in the coming months. This question requires an explanation which I shall attempt to accomplish in this article.

Designing a microcomputer with a new bus is not an easy decision to make. We at Heath were fully aware of the S-100 bus and the vast number of accessory cards available for this bus. In the decision to select a bus for 8080-based microcomputers, we considered the following items:

- 1) What signal should appear on the bus?
- 2) The electrical integrity of the bus.
- 3) The cost of the bus.
- 4) Physical considerations.
- 5) The expandability.

#### **SIGNALS**

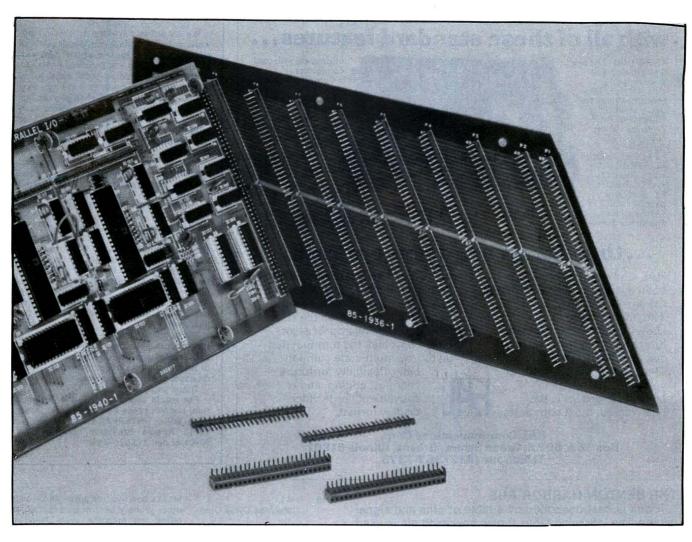
In dealing with the question of what signals should be on the bus, we looked at many existing designs. Unfortunately, the S-100 bus originated in a machine without a system controller chip. Many of the S-100 bus signals are obsolete in a design incorporating a system controller chip. Additional signals appearing on the S-100 bus originally were intended for support of dynamic memories included in some of the early microcomputers. As the dynamic memories tend to disappear from the industrial and hobby market, these signals also become obsolete. Dedicated control lines to operate a particular board are a lesser choice for placing on the bus. They tend to solve immediate problems, but become obsolete very quickly.

The well-designed bus is one in which the complete system is considered. One where the designer looks down the road as far as possible, considering new technology and future expansions. Lines should be used by most boards in the system.

A look at the signals that appear on the "Benton Harbor" bus will reveal that the above philosophy is strictly adhered to, and that only generalized control lines appear on the bus. These are the memory read/write lines; the I/O read/write lines; data and address lines; and control lines such as hold, hold acknowledgement, ready-in, and ROM disable for DMA control.

#### Schematic of pin designations of the Benton Harbor Bus.

|      | -    | - accignations            |     | Bonton Harbor Bus   |
|------|------|---------------------------|-----|---------------------|
| S    | 201- | - 5                       | 201 |                     |
|      | 24   | GND*                      | 49  | + 8 V               |
|      | 23   | MEMW                      | 48  | +8 V                |
|      | 22   | Ø2                        | 47  | +18V                |
|      | 21   | IOW                       | 46  | ROM DISABLE         |
|      | 20   | RDYIN*                    | 45  | A <sub>15</sub>     |
|      | 19   | M1                        | 44  | A <sub>14</sub>     |
|      | 18   | GND *                     | 43  | A <sub>13</sub>     |
|      | 17   | D <sub>7</sub>            | 42  | A <sub>12</sub>     |
| ×    | 16   | D <sub>6</sub>            | 41  | $\overline{A_{11}}$ |
|      | 15   | D <sub>5</sub>            | 40  | A <sub>10</sub>     |
|      | 14   | $\overline{D_4}$          | 39  | A 9                 |
|      | 13   | <del>D</del> <sub>3</sub> | 38  | A <sub>8</sub>      |
|      | 12   | <del>D</del> 2            | 37  | A <sub>7</sub>      |
|      | 11   | $\overline{D_1}$          | 36  | A 6                 |
|      | 10   | $\overline{D_0}$          | 35  | A <sub>5</sub>      |
|      | 9    | ĪNT2★                     | 34  | A <sub>4</sub>      |
|      | 8    | ĪNT₁*                     | 33  | A 3                 |
|      | 7    | ĪNT <sub>7</sub>          | 32  | A <sub>2</sub>      |
|      | 6    | ĪNT <sub>6</sub>          | 31  | $\overline{A_1}$    |
|      | 5    | ĪNT <sub>5</sub>          | 30  | A 0                 |
|      | 4    | INT <sub>4</sub>          | 29  | RESET               |
|      | 3    | ĪNT3                      | 28  | MEMR                |
|      | 2    | -18V                      | 27  | HOLD*               |
|      | 1    | GND                       | 26  | I/OR                |
|      | 0    | GND                       | 25  | HLDA*               |
| * HE | ATH  | COMPANY RESER             | VES | THE RIGHT           |
| 10   | CHA  | ANGE THESE PIN            | DF2 | GNATIONS.           |



The Benton Harbor Bus

#### **ELECTRICAL INTEGRITY**

Electrical integrity implies that the designer has followed sound design practices and thoroughly analyzed the electrical characteristics of the bus. It means that the bus is designed so that it is not sitting on the hairy edges of oscillation, cross talk or radiation. Electrical integrity was a prime design goal in this project. Consideration was given to high speed signals on the bus so that they did not fall along side another line which may cause interference in either direction. A good example of this on the Heath bus is the obvious omission of the 18 MHz clock because in our judgement 18MHz does not mix well on a bus. Instead, this was replaced with a much lower frequency phase two clock.

#### **CLOCK**

Cost is always the prime concern to a computer hobbyist. While the S-100 bus may sound attractive initially to the hobbyist, you must remember that you are paying dearly for all these lines that are sometimes used very little or not at all. Currently, a 15-slot mother board for the S-100 bus sells in the range of \$100. Compare this to the H-8 which sells complete, with all the connectors for a 10-position bus, including the CPU, the front panel, the cabinet, power supply, and all the software for \$375. The gold edge connectors used on the S-100 bus is yet another hold-over from industrial/military computer era. We at Heath feel a less expensive, reliable and proven

connector used on the H-8 is a good example of price trade-offs which our customers have come to expect. An additional point to consider in the cost trade-offs is the expensively tooled tongue required on each card to fit the S-100 bus connectors.

#### PHYSICAL CONSIDERATIONS

When designing a hobbyist computer for today, many of the machines are placed in an attractive surrounding. This places some basic physical constraints on the card size. By going to the 50-pin bus, we were able to bring an attractively styled computer to the market.

When the builder completes the construction of his computer, and wants to do some experimentation, or requires service, he wants quickly to locate a pin on the bus. On the Benton Harbor bus, all address and data lines run sequentially. Additionally, the interrupts all correspond to the appropriate bus pins. For example, interrupt 3 is pin 3; interrupt 4 is pin 4; data zero is pin 10; data 1 is pin 11, and so on. Address lines are done in the same manner. Address A0 is pin 30; A1 is pin 31; A2 is pin 32. This is common sense layout.

#### **EXPANDABILITY**

The Heath bus was designed with the electrical considerations to allow it to be expanded from the last connector on the mother board. This expandability feature will be utilized in coming products.

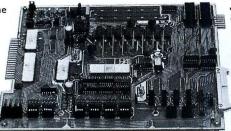
AUGUST 1977 INTERFACE AGE 103

### If you want a microcomputer with all of these standard features...

- 8080 MP(I (The one) with growing software support)
  • 1024 Byte ROM
  (With maximum capacity of 4K Bytes) 1024 Byte RAM
- (With maximum capacity of 2K Bytes)
  • TTY Serial I/O
- EIA Serial I/O • 3 parallel I/O's • ASCII/Baudot

terminal com-

patibility with TTY machines or video units Monitor having load, dump, display, insert and go functions



 Complete with card connectors • Comprehensive User's Manual, plus Intel 8080 User's Manual

Completely factory assembled and tested—not a kit

· Optional accessories: Keyboard/video display, audio cassette modem

interface, power supply, ROM programmer and attractive cabinetry...plus more options to follow. **The HAL MCEM-8080. \$375** 

## ...then let us send you our card.

HAL Communications Corp. has been a leader in digital communications for over half a decade. The MCEM-8080 microcomputer shows just how far this leadership has taken us...and how far it can take you in your applications. That's why we'd like to send you our card-one PC board that we feel is the best-valued, most complete

microcomputer you can buy. For details on the MCEM-8080, write today. We'll also include comprehensive information on the HAL DS-3000 KSR microprocessorbased terminal, the terminal that gives you multi-code compati-

bility, flexibility for future changes, editing, and a convenient, large video display format.

20

**HAL Communications Corp.** Box 365, 807 E. Green Street, Urbana, Illinois 61801 Telephone (217) 367-7373

#### **CALL FOR ARTICLES**

We are actively seeking articles in hardware, software and general applications of microcomputers in industrial, business, science, medicine and personal fields.

Articles authored by individuals during leisure time are remunerated at a rate from \$15.00 to \$50.00 per published page and articles describing company projects carry author and company byline, but no honorarium is offered. Articles accepted will be acknowledged with a binder check within thirty days of receipt.

Manuscripts should be double spaced. typewritten pages, one inch margins, and not less than three and one-half (31/2) pages in length (one published page). Pages should be numbered to insure correct text. Photographs should be numbered and labeled on the backside with a description. Tables, listings, etc., shall be on separate sheets. Photos should be taken with uniform lighting and background, in the form of glossy black and white prints. Computer listings shall be printed using a new ribbon to assure darkest print copy. Authors shall supply a statement of their background, expertise and level of accomplishment.

The publisher assumes no responsibility for artwork, photos, models, or manuscripts. Manuscripts are not acknowledged or returned unless accompanied by an addressed, stamped, return envelope.

Thank you.

For article submittal or further information, contact Linda Folkard-Stengel, Associate Editor, INTERFACE AGE Magazine, 13913 Artesia Boulevard, Cerritos, CA 90701 or call 213-926-6629.

data read cycle.

#### THE BENTON HARBOR BUS

A bus is best described by a table of pins and signal names. The following table shows how each pin is used on this design.

#### H-8 SYSTEM BUS CONFIGURATION

|                 |   | oo oom momamon  |
|-----------------|---|---|
| <b>PIN</b> 0, 1 | SIGNAL NAME<br>GND (Ground)             | DESCRIPTION  GND is the main power supply return and the signal common for the entire system. Two connector positions and wide foils ensure a low impedance connection.                                     |
| 2               | - 18 (NEG 18<br>Volts Nominal)          | An unregulated negative voltage is used with on board regulators to supply power for substrate bias on MOS integrated circuits or for use in RS-232 Interfaces.   |
| 3-7             | INT 30 - INT 70                         | INTERRUPT 30 through INTERRUPT 70 connects RST3 through RST7 interrupt signals to the CPU board. These lines are pulled to low level by open collector logic allowing multiple devices to share interrupts. |
| 8, 9            | Not Dedicated                           | The CPU board has jumper pads available to jumper INT 1 and INT 2 to these bus lines in order to share the front panel interrupts, if desired. Otherwise these lines may be used by the customer.           |
| 10-17           | D0 - D7                                 | Data Bus signals D0 through D7 are fully buffered and interfaced by three state transceivers. The use of negative true signals reduces buffer stages, thus holding propagation delays to a minimum.         |
| 18              | CPU GND<br>(Available for<br>Other Use) | This line is grounded on the CPU board but can be floated for other use by removing one jumper on the CPU board.  |

19 (Machine Cycle One)

> **RDYIN** (Ready In)

Normally this line is at logic one which allows the CPU to run at full speed. If any device requires more time to respond than is normally allowed by the processor, the device may pull the RDYIN line low causing wait cycles to be executed until it is finished and releases the line.

M1 is a positive true pulse (as are all the

other primary control pulses) that sig-

nifies the machine cycle being executed is an instruction fetch and not a

(Input/Output Write)

IOW is one of the five master I/O and Memory control lines. The IOW signal strobes data from the data bus to an output device whose address appears in the lower eight bits of the address

02 (Phase Two)

This buffered signal from the master clock is used to synchronize system devices connected to the bus. Its uses, one of which is to drive the H-8 front panel interrupt timer, are many and varied.

23 MEMW (Memory Write)

CPU GND

Other Use)

(Available for

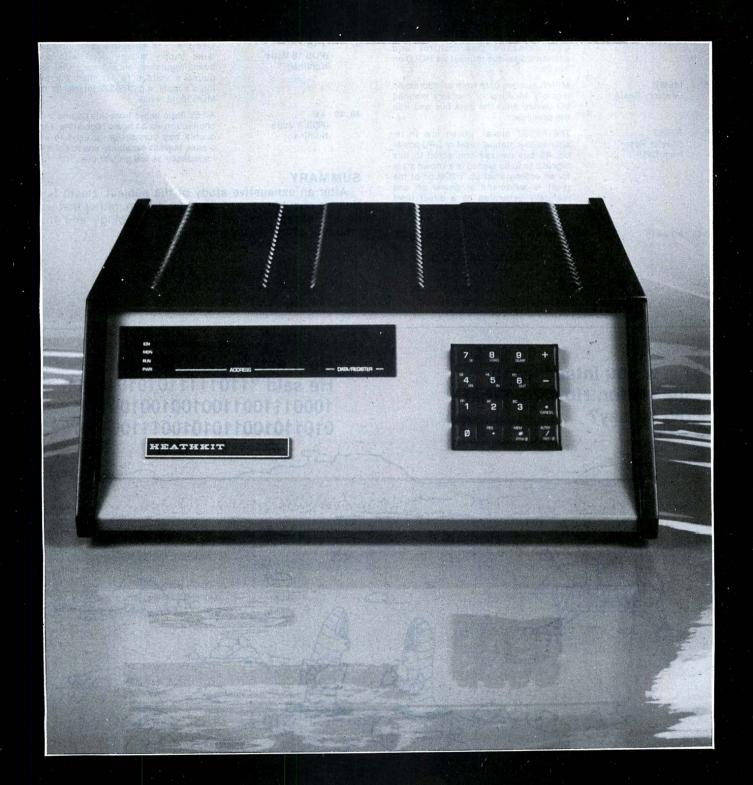
MEMW causes data on D0-D7 to be stored in a location supplied by the address bus at the trailing edge of the pulse. Memory mapped I/O devices also transfer data with this signal

The positive going signal is easily terminated with a resistor to ground reducing ringing caused by fast transitions of this pulse. No power supply is required to source a terminator keeping the bus simple. This is true of all five master control signals on Pins 19, 21,

23, 26 and 28.

As with Pin 18, there is a CPU ground which may be removed to make this bus line available for other use.

104 INTERFACE AGE



**Heath Company H8 Microcomputer** 

| 25 | HOLD<br>(Hold Acknowledge<br>from CPU) | HOLD informs the system that the CPU has placed all data, address, and control lines in a tri-state condition for DMA (Direct Memory Access) control of the system.  |
|----|--|--|
| 26 | IOR<br>(Input/Output Read)             | During the time IOR is active, informa-<br>tion placed on the data bus by an ad-<br>dressed input device is read into the<br>CPU.  |
| 27 | HOLD<br>(Hold Request to CPU)          | HOLD is pulled low by a DMA device requiring use of the system bus. The CPU releases bus control and acknowledges the request via HOLD on Pin 25.  |
| 28 | MEMR<br>(Memory Read)                  | MEMR strobes data from an addressed memory location or memory mapped I/O device onto the data bus and into the processor.  |
| 29 | RESET<br>(Master Reset<br>from CPU)    | The RESET signal, pulled low in response to a manual reset or CPU power on. All bus devices connected to this signal line to be placed in a known state for an orderly start up. Initiation of the reset is automatic at power on and manually generated by a direct front |

30-45 A0 - A15

|        |                                   | dress lines that when properly decoded, select any one of 65,536 memory locations or 256 I/O ports. Again, these bus signals are negative true to reduce propagation delays in the buffers.               |
|--------|-----------------------------------|---|
| 46     | ROM DISABLE                       | When the X1, X2 jumper on the CPU is installed, this signal effectively shuts off the on-board front panel monitor ROM allowing a test board or other ROM board to use the monitor address space.         |
| 47     | + 18<br>(POS 18 Volts<br>Nominal) | Like the - 18 volts, this is an unregulated supply voltage used with onboard regulators on any card that requires a voltage higher than the 5V logic supply, e.g., RS-232 interfaces or MOS logic levels. |
| 48, 49 | +8<br>(POS 8 Volts<br>Nominal)    | All 5V logic is fed from this double bus connection via on-board regulators. The double bus connection is used to in-   |

#### SUMMARY

panel to CPU connection actuated by

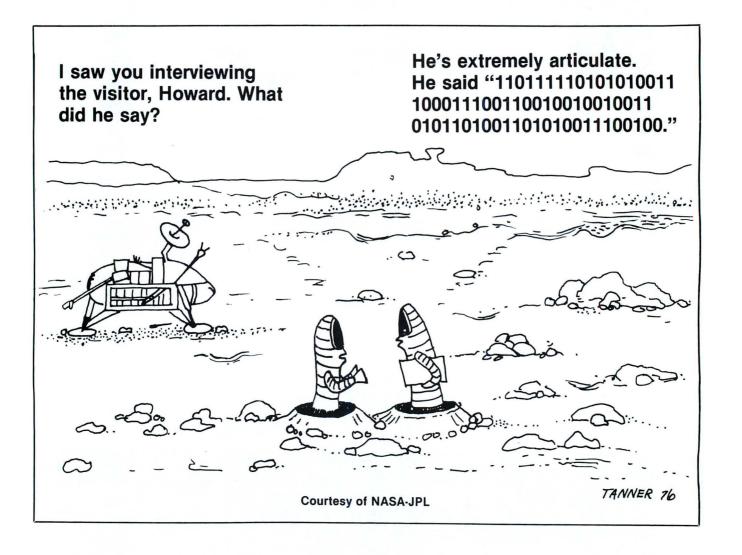
These are the sixteen fully buffered ad-

pressing the reset keys.

After an exhaustive study of the subject, Heath felt that we should not copy an older design, rather that we should accept the advances of technology and the maturing of the hobby market.

crease current capability and lower the

impedance as the ground bus.



# NEW PRODUCTS

#### **DE68DT Microcomputer**

The DE68DT Microcomputer is a fully integrated, completely self-contained system. Keyboard, 20 column alphanumeric display, 40 column impact printer, single or dual minicassette tape drives, miniature floppy disc, RS232-C ports for supporting optional CRT, printer, or modems, numeric keypad, and nine slot card cage are all integrally fitted into the case with the 6800 CPU and power supplies. RAM expansion to 65K bytes, and 16K byte EPROM cards are available option which can be installed easily by the user.



The DE68DT is specifically designed for such applications as Instrument Control, Data Acquisition and Reduction, Transaction Logging, Microprocessor Software Development, and Microprocessor Education. It can also be used for small business accounting with the addition of appropriate software. A dual floppy disc drive, or other user peripherals may be coupled easily to the I/O bus to provide customization to fit any user requirement.

customization to fit any user requirement.

The extensive 'DEbug' command set includes: Memory Examine and Change, Search, Move Memory Block, various tape and disc commands, Multiple Breakpoints with Loop Counters, Register Examine and Modify, Single-Step, Trace, various printer commands, and Hexadecimal Calculator Functions. A unique mnemonic translator permits software debugging in assembly language. Entry/ Display, Search and Print modes are selectable, offering assembly mnemonics, hexadecimal or ASCII characters.

Two versions of the DE68DT are available. The standard DE68DT is a desk top model which weighs less than 30 lbs., depending on options. Dimensions are 22¼"w x 17½"d x 7½"h. The DE68C is a compact unit without integral miniature floppy disc, but otherwise similar to the DT. Weight is under 25 lbs.; dimensions are 19½"w x 20"d x 5½"h. Both units are fully portable. The microcomputers are priced from \$2200. Delivery is normally 30 days ARO. Quantity discounts and leasing programs are available. For more information, contact Digital Electronics Corporation, 415 Peterson St., Oakland, CA 94601, (415) 532-2920.

**CIRCLE INQUIRY NO. 100** 

#### Life-Size Television for Smaller Spaces

Advent's new Model 10 VideoBeam® projection television has been designed to bring the unique VideoBeam television viewing experience into homes where space is at a premium. Its bright, clear 5' diagonal-measure picture—4' wide by 3' high—is 10 times the area of the 19" color TV picture most people watch at home. Yet the new Model 10 takes up less living space than was previously possible with VideoBeam projection television.



The new Model 10 is a two-piece color television set that receives regular broadcasts, and may also be connected to other sources including video games and cassette machines. All solid-state circuitry and the usual color TV operating controls are housed in a walnutveneered console which is about the size of an end table and has been designed to complement virtually any room setting. But instead of displaying the picture on a conventional color picture tube, the Model 10 projects it to a separate 5' diagonal screen. Screen-toprojector distance is 6', so that the set and a small group of viewers can comfortably fit into a viewing area no more than 12' long. When not in use, the console may be rolled out of the way under the screen.

Like Advent's other VideoBeam projection television sets, the new Model 10 uses three individual projection tubes, one for each of the red, blue, and green signals that make up a color TV picture. The images from three 5" singlecolor tubes are projected simultaneously by three 5", four-element lenses; the red, blue, and green images converge at the screen to create a full-color picture free of the phosphor dot or stripe patterns of the conventional color picture tube. Advent's three-tube projection method, unique to home projection television sets, is why its VideoBeam television sets provide a larger and far brighter picture than those that work simply by enlarging a regular color set's picture with a single lens. And like the picture, sound is reflected from the screen (a high-fidelity loudspeaker is located in the front the console beneath the projection tubes).

For further information, contact Advent Corporation, 195 Albany St., Cambridge, Mass. 02139, (617) 661-9500.

**CIRCLE INQUIRY NO. 101** 

#### The PET

The PET is a computer. But a very different computer from any you have ever seen before. The PET is a personal computer; it stands for Personal Electronic Transactor. It is very compact, measuring just 16.5" wide by 18.5" deep and 14" high, and quite portable; it can be carried and used anywhere. It operates on ordinary current available in any office, home or factory.

The PET has a television screen, a keyboard as simple to use as a typewriter and a self-contained cassette recorder which is the source for programs and storing data in connection with these programs. And it has, in its standard configuration, a 4K (4000 byte) user memory or, as an option, an 8K user memory. (This is in addition to the 14K operating system resident in the computer).

The PET has a Machine Language monitor in addition to BASIC so that a sophisticated user may program the microcomputer itself. (There

also will be Machine programs that Commodore will make available from time to time.) The Commodore PET. So simple to learn and to use. Yet the PET can also boast of Advanced Screen Editing—a feature comparable to instant word-processing and found only a a few of the larger, more sophisticated computers.

Additional programs, additional memory boards, a telephone interface system, a printer, an IEEE interface and a floppy disc drive are among the components that are being made available to those users who may perceive a need.

A second cassette is available through a built-in interface. This allows true file-keeping and places the PET as a true and conventional electronic data processing system equivalent to just about any large commercial computer. A user controllable port consisting of an 8-bit Alpha connector is also built-in for "do-it-yourself" attachments...such as a music synthesizer, speakers, a light controller... for fun and games.

For further information, contact Commodore Business Machines, Inc., 901 California Ave., Palo Alto, CA 94304.

**CIRCLE INQUIRY NO. 102** 

#### Memorex 550 Flexible Disc File

The Memorex 550 Flexible Disc File is a compact, direct access, disc storage unit that is used to record and read back digital information. Utilizing a Memorex Markette Disc Carridge or IBM Diskette, the recording capacity of the 550 is 243 kilobytes in IBM 3740 format or up to 800 kilobytes of unformatted data.



This new file from Memorex contains a disc drive mechanism, read/write head, head positioning device and local cotnrol electronics that are assembled on a single printed circuit board. Among the file functions on the PCB are read/write amplification and transition detection, index detection, and drivers for both track positioning and head loading.

The 550 features the high reliability and performance levels that are so critical for a variety of information storage and processing applications—data entry, small business systems, terminals, point-of-sale, programmable calculators, word processing, control and test systems and mini/microcomputers. Additionally, operational simplicity and fail-safe functions limit the level of operator training that is required.

An exclusive door-controlled latch/eject mechanism on the 550 makes cartridge insertion and removal quite literally a "pop-in/pop-out" operation. A "lock stop" feature also makes it impossible to close the door on a cartridge that is not fully inserted or removed.

The flexible disc cartridge employed in the 550 is made of a 7%" polyester disc substrate coated with a magnetic oxide. For protection

INTERFACE AGE 107

during handling, operation and storage, the cartridge is enclosed in a flexible plastic envelope that is 8" square by 1/16" thick.

For further information, contact Memorex Corporation, OEM Division, Equipment Products Group, San Tomas at Central Expressway, Santa Clara, CA 95052.

**CIRCLE INQUIRY NO. 103** 

#### **EBNEK 77**

Based on the powerful TMS 9900 16-bit microprocessor.

The EBNEK 77, a complete minicomputer system, is shipped complete, including 16K bytes of 350ns RAM, easily expanded to 128K bytes in the standard office compatible cabinet. The power supply will support a completely expanded system, providing 7.5V at 32A along with ± 15 at 2A. A Phi-Deck tape transport, keyboard, and video monitor peripherals are supplied with the system. All peripherals are interfaced to EBNEK 77 and supported by the operating system. Also, a spare RS 232 I/O port is provided. The video monitor is driven by a 64 character by 16 line character generator and a 256 by 240 dot matrix graphics generator, all provided with EBNEK 77.

The operating system contains I/O drivers for all peripherals, including graphics display with plotting routines. A text editor and file based Phi-Deck I/O reside in 4K bytes of EPROM. Standard software includes a resident assembler, text editor, compiler for a system programming language, and computer games. EBNEK software support includes access to our user updated program library.

Options include printer interfaces, a floppy disc interface, a floating point processor, a 64 bit parallel I/O port, a multi-task controller, and additional terminals.

The EBNEK 77 price is \$2,770.00 in kit form, and \$3,800.00 assembled and tested.

This system provides cost effective text manipulation, business data processing, numerical analysis, and the ability to handle complex personal computing applications. The EBNEK 77 gives personal computer users a higher level of processing capability. For further information contact Ted Davis, 254 N. Washington, Wichita, KS 67202, (316) 265-0131, or Kenbe Goertzen, Box 164, Manhattan, KS 66502, (913) 539-6104.

**CIRCLE INQUIRY NO. 104** 

## APL Character Set for Data Communication Terminals

APL (A Programming Language) is an alternate character set option on all Centronic's teleprinter models. This option features a ninepin print head that produces a 7 x 9 dot matrix character pattern with true underscore and ascenders and descenders on the primary ASCII character set. An engraved APL keyboard is also part of the option.



The microprinters sell for \$595. Aimed at the home, hobby, and microprocessor markets, the 240 character-per-second Micro-1 is offered as a complete unit including case, power supply, 96 character ASCII generator and interface, paper roll holder, low paper detector, bell, and multi-line asynchronous input buffer.

The microprinter produces copy on aluminum coated paper by discharging an electric

arc to penetrate the coating, which is less than one micron thick. Toners and ribbon are not required.

The printed characters, unlike those resulting from thermal printing, are impervious to light, temperature, and humidity. In addition, the finished printed page may be reproduced on any office copying machine.

The microprinter electronics allows the machine to produce copy at a rate of 180 lines per minute on 4¾ inch roll paper and provides the user software selection of 20, 40, or 80 columns. Initial deliveries are slated to occur during the last calendar quarter of 1977.

For further information, contact Centronics, Hudson, New Hampshire 03051, (603) 883-0111. CIRCLE INQUIRY NO. 105

#### New Power Module Model No. DA200

Abbott's new DA200 series of high efficiency switching regulated power modules are designed specifically for computer and com-

puter peripheral applications. Each unit is operable from user selectable inputs of 115 VAC  $\pm$  10% single phase or three phase Wye, or 230 VAC  $\pm$  10% single phase or three phase Delta. Three units are available with outputs of 5 VDC,  $\pm$  12 VDC and  $\pm$  15 VDC with total power of 200 watts. Full power is available at ambient temperatures of 35 °C with 50% derating at 71 °C.



# AN OPEN LETTER TO COMPUTER HOBBYISTS:

Starting this month, you will see a slogan underneath our name. It reads "Publishing personal computing books is our business." I was tempted to add ". . . Not a sideline." Look at who publishes books now: short course companies, instrument manufacturers and general publishers. People who, for the most part, are interested in something other than hobbyists. An editor for a major publishing company recently told me "I can publish these books on one hand and do something else with the other. I don't have to get involved in their stuff myself." That kind of "know-it-all" attitude on the part of major publishers is one of the reasons I started my own company. I have been interested in computers for 15 years (I have an Altair 8800B) and have been in publishing for nearly 10 years. I don't treat book publishing or hobbyists as sidelines. If you have comments about this, or if you would like a list of our books, or if you would like to write a book for us, please contact me. Thank you.

"See us at Booth 211 in Atlantic City"



Merl Miller dilithium Press P.O. Box 92 Forest Grove, OR 97116

108 INTERFACE AGE

Line and load regulation is less than 0.5% and peak-to-peak ripple is less than 100 MV. Standard features include overvoltage protection, short circuit protection, overtemperature shut-down and remote error sensing. Measured efficiency is as high as 80%. All this performance is packaged in a low profile case only 5.5" x 11.0" x 2.5"

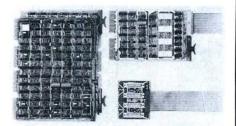
Other series in this new line include 50 and 100 watt output units plus 41 to 52 VDC input models at 50, 100 and 150 watts output. Price, \$350.00 (For Unit Quantities).

For further information, and complete details on other lines of power modules, send for Abbott's 1976-1977 Power Supply Catalog. Abbott Transistor Laboratories, Inc., 5200 W. Jefferson Blvd., Los Angeles, CA 90016, (213) 936-8185, Telex 69-1398.

**CIRCLE INQUIRY NO. 106** 

#### Mighty-Mux 11L

Mighty-Mux 11L is a complete input/ouput system for Digital Equipment Corporation's small, but inherently powerful LSI-11 processor. Mighty-Mux uses Direct Memory access rather than individual character handling. This technique can reduce I/O processing overhead from over 70% to less than 2%.



All important parameters are under program control on a port-by-port basis. For instance, each port is assigned its own input and output

## THE **ANSWER BOOKS FOR** HOME **COMPUTER** HOBBYISTS-

#### HOME COMPUTERS: 210 QUESTIONS AND ANSWERS

by Rich Didday

Volume 1: Hardware

This book is for the person with a micro-computer who wants to get an idea of what it can be like to use it to the fullest. \$7.95 Summer '77

Volume 2: Software

A companion volume to the above book, this guide leads the new micro owner through the thorny problems surrounding the selection and use of software. \$6.95 Summer '77

#### STEP BY STEP INTRODUCTION TO 8080 MICROPROCESSOR SYSTEMS

by James Melsa and David Cohn This is a more advanced book which will show you how to put together what you've learned to build systems and applications that really exploit the capabilities of your micro. \$7.95 Summer '77

#### HOME COMPUTERS: A BEGINNER'S GLOSSARY AND GUIDE

BY Merl Miller and Charles Sippl This book provides the fundamental knowledge and skills for the new micro owner. Written in a lively and straightforward style, it takes the mystery out of the basic mathematical and logical principles involved in working with computers. \$6.95 Summer '77

#### HOME COMPUTER PRIMER

by Charles Sippl

This book is for people who know nothing whatever about micro-computers, but have discovered that computers have become a fact of life-a fact they can no longer ignore. \$6.95 Summer '77

#### HOME COMPUTER DIGITAL **ELECTRONICS**

by Merl Miller and David Irwin

This book provides the beginner with some basic ideas of switching theory and digital circuits. It also introduces him to some of the most important ideas underlying the computer system. \$6.95 Fall '77

#### 8080 MICROCOMPUTER **EXPERIMENTS**

by Howard Boyet

This book contains over 55 software, hardware, and interfacing experiments with enough theory to allow one with no previous micro-processor or computer experience to proceed to a relatively advanced level of competence. \$91.95 Summer '77

"See us at Booth 211 in Atlantic City"



Prices subject to change without notice.

dilithium Press P.O. Box 92 Forest Grove, OR 97116

**Publishing Personal Computing Books is Our Business!** 

# MERCIN

#### THE INTELLIGENT VIDEO INTERFACE

MERLIN is the best ASCII/Graphics board now available for the S-100 bus . . . and at an unbelievable price!

Compare these features to any other video interface:

- ☆ 160H x 100V resolution bit mapping graphics
- ☆ On-board ROM (Monitor/Editor) option
- ☆ 40 characters by 20 lines, character ROM generated (hardware)
- ☆ Keyboard interface (with power)
- ☆ Programmable modes and display format
- ☆ Serial I/O port
- ☆ Low power . . . only 600ma at +8V
- ☆ Extremely fast (uses DMA)
- ☆ Comprehensive User Manual . . 200ps
- ☆ American 60HZ or European 50 HZ operation.

Designed-in expandability means maximum versitility at minimum cost. Add-on options now available (in kit form) include:

- ☆ Super Dense Graphics (M320-K).....\$39 ☆ Lower case characters (LC) .....\$25 ☆ Serial-to-parallel expansion Kit (MSEK-K) .....\$45 ☆ 1500 Baud (software) cassette interface kit (MCAS-K)......\$29
- ☆ 2K x 8 Mask ROM; graphics. cassette, & extended editing software (MEI) .....\$35 ☆ 2K x 8 Mask ROM/256 RAM;

The MBI ROM software is designed to allow turnkey operation and sophisti-

cated editing and scrolling.

Monitor Editor Software (MBI) ..\$39

Ask to see a demonstration of MERLIN at your nearest computer store. Many dealers now stock MERLIN and there is nothing like a hands-on demo for really evaluating a product. We know you'll be sold.

MERLIN Kit with Manual ......\$269 MERLIN, assm'd & tested . . . . . . \$349 MERLIN User Manual .....\$ 10

For fast information, write us direct! MC and BAC accepted.

"See us in Boston"

**CIRCLE INQUIRY NO. 34** 



MınıTerm Associates, inc.

# The Perfect Cover-Up!!!

For The Computer Designer and Builder



**VTE 101** TERMINAL ENCLOSURE \$78.95



**KBE 101** KEYBOARD ENCLOSURE \$24.95



**TVT 101** TYPEWRITER ENCLOSURE \$47.95

... AND THESE FEATURES ARE STANDARD:

- High Impact Structural Plastic Construction
- Flame Retardant
- Attractive Professional Appearance Easily Machinable Using Ordinary
- Woodworking Tools
  Highly Adaptable to Your Needs
  Ribs & Bosses for Component
- Mounting Molded Ventilation Grills
- Removable Keyboard Mounting
- Available Unfinished or in Three Standard Colors

Inquire about special designs
See us at Booth 504 - Atlantic City

#### **Enclosure Dynamics Products Are** Distributed Worldwide By:

CALIFORNIA

Byte Shop Computer Store of Diablo Valley 2989 North Main Street Walnut Creek, CA 94596 415-933-6252

Computer Land 22634 Foothill Blvd. Hayward, CA 94542 415-538-8080

Computer Land of West L.A. 6840 La Cienega Blvd. Englewood, CA 90302 213-776-8080

Computer Playground 6789 Westminster Ave. Westminster, CA 92683 714-898-8330

COLORADO

Byte Shop 2040 30th Street Boulder, CO 80301 303-449-6233

Byte Shop 3464 So. Acoma St. Englewood, CO 80110 303-761-6232

Gateway Electronics 2839 West 44th Ave. Denver, CO 80211 303-458-5444

Miti-Mini Computer Co. 621 So. Broadway Denver, CO 80209 FLORIDA

Microcomputer Systems 44 So. Dale Mabry Hwy. Tampa, FL 33609 813-879-4301 ILLINOIS

American Microprocessors Equipment & Supply Corp. 20 North Milwaukee Ave. Prairieview, ILL 60069 312-634-0076

Bits N Bytes Computer Store 2928 West 147th S Posen, ILL 60469 312-389-7112

Lillipute Computer Mart 4446 Oakton St. Skokie, ILL 60076 312-674-1383

INDIANA

The Computer Mart of Indiana 901 Strong Ave. Elkhart, IN 46514 219-293-7378

IOWA

Micro Bus, Inc.
1910 Mt. Vernon Rd. S.E. 3455 So. West Temple
Cedar Rapids, Iowa 52403 Salt Lake City Utah 84115
319-364-5075 801-486-4311

KENTUCKY

Computer Land of Louisville 813 B Lyndon Lane Louisville, KY 40222 502-425-8308

MARYLAND

Computer Land of Rockville 16065 Frederick Rd. Rt. #355 Rockville, Maryland 20850 301-948-7676

**MASSACHUSETTS** 

Computer Mart, Inc. 1097 Lexington St. Waltham, MA 02154 617-899-4540

Microtec 23 Hamburg St. Springfield, MA 01107 413-734-3818

MICHIGAN

Compumart, Inc. 1250 North Main Ann Arbor, Mi 48103 313-994-4445

MINNESOTA Microprogramming, Inc. 12033 Riverwood Drive Burnsville, Minn. 55337 218-894-3510

MISSOURI

Gateway Electronics 8123 Page Blvd. St. Louis, MO 33130 314-427-6116

MONTANA

Computers Made Easy 415 Morrow Bozeman, MT 59715 406-586-3065

NEW JERSEY

Computer Land of Morristown 2 De Hard St. Morristown, NJ 07960 201-539-4077

William Electronics Supply 1863 Woodbridge Ave. Edison, NJ 08817 201-985-3700

NEW YORK

Computer Land of Tonawanda 1612 Niagara Falls Blvd. Tonawanda, NY 14150 716-836-6511

Computer Mart of New York 118 Madison Ave. New York, NY 10016 212-686-7923

Computer Microsystems 1309 Northern Blvd. Manhasset, NY 11030 516-627-3640

The Computer Shoppe 444 Middle Country Rd. Middle Island, NY 11953 516-732-4446

**PENNSYL VANIA** 

Lectro-Media, Ltd. ew Market-Front & Pine Philadelphia, PA 19105 215-925-4477 800-523-2906

TEXAS

The Micro Store 634 So. Central Expwy Richardson, TX 75080 214-231-1096

UTAH, NEVADA, IDAHO

#### **FOREIGN** DISTRIBUTORS

**ENGLAND** 

West Hyde Developments, Ltd.
Ryefield Crescent
Northwood, Middlese
England HA6 1NN

GERMANY

Datameg KG D 8011 Putzbrunn Munich, Germany 4-60-49-93

AUSTRALIA

Digital Electronics Pty. Ltd. 4/29 Hotham PDE Artarmon, N.S.W. Australia 438-2444

#### **ENCLOSURE DYNAMICS, Inc.**

P.O. Box 6276

Bridgewater, New Jersey 08807 201-725-7982

buffers in core - any size, any location. The program also controls parity mode, character size, automatic echo and baud rates for each port. Asynchronous or synchronous operation is selectable.

The savings in I/O overhead coupled with the availability of four status and control lines on each port make it possible to interface with printing and graphics terminals, CRT's, Modems, floppy discs, line printers, card readers and other devices equipped with serial

The 11L design is taken directly from EDSI's highly successful Mighty-Mux for the Data General NOVA. The widely distributed NOVA Mux has performed superlatively in general purpose and communications applications. Principal users are performance conscious turnkey system houses.

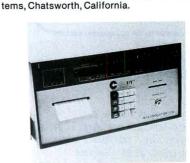
In addition to LSI-11 and NOVA DMA multiplexers EDSI offers the widely used IRIS timesharing system and access to an array of business application software.

The Mighty-Mux 11L is priced at \$1600 for the basic 4 port module. Expansion is in 4 port increments to 128 ports. Quantity discounts are offered. Support software and equipment is available. More information on Mighty-Mux 11L is available from Educational Data Systems, Inc., 1682 Langley Ave., Irvine, CA 92714, (714) 556-4242.

> **CIRCLE INQUIRY NO. 107** Interrogator 770

An all electronic, maximum security access control unit which can monitor, control and document the movement of up to 1500 indivi-

dual cardholders at 16 separate remote access locations has been introduced by Cardkey Sys-



The new Interrogator 770 Central Controller provides up to 32 different access level codes and performs dozens of alarm monitoring functions. It is completely interchangeable with Cardkey's larger Interrogator 880 maximum security system, without any modifications in wiring or system parameters.

Additional features of the Cardkey Interrogator 770 include memory buffer, built-in printer to provide a hard copy record of all transactions, and optional computer and magnetic tape interfaces for data processing, payroll and other source data collection applications.

For further information on the new Interrogator 770 maximum security access control unit, contact: Cardkey Systems, a division of Greer Hydraulics, Inc., 20339 Nordhoff St., Chatsworth, CA 91311. CIRCLE INQUIRY NO. 108

#### Kit for Fast Bipolar Emulation of the 8080A Microcomputer

Bipolar emulation of the popular Intel 8080A microcomputer system, with speed improved by as much as 9 times, is now possible with a new 8080 Emulator Kit from Signetics.



The kit, designated the 3000KT8080SK, is a microprogrammed microprocessor using Schottky LSI components to implement the 8080A emulation at speeds that allow expansion of existing 8080A-based systems with no change in software.

Features of the kit include: fully static operation (DC to 150ns), a single 5 volt power supply, hardware multiply and divide, and full vectored interrupt to any location within 64K of memory.

The kit provides the standard address, data, status and control buses as defined in the Intel 8080 Microcomputer System Manual.

The 3000KT8080SK is now available from Signetics and its authorized distributors at a unit price of \$299.

For further information, contact Signetics, 811 East Arques Avenue, Sunnyvale, California 94086, (408) 739-7700. CIRCLE INQUIRY NO. 137

#### A Real Word Processor

This microcomputer based word processing system is available for under \$6,000, complete and is based on the field proven COMPAL-80 computer and Xerox Corp.'s Diablo 1620 daisy wheel printer.



It contains features found only on systems costing \$20,000 or more. Among these are: complete text editing on a large CRT; insertion or deletion of text, and the ability to move blocks of text anywhere; variable speed scrolling of entire text on the CRT, forwards and backwards; ability to search for all occurrences of a specific word or group of words and replacement with alternative word or words; storage and retrieval of finished text on low-cost Phillips audio cassettes at the rate of 240 characters per second; a variety of printing options, including variable line length, 1-5 spaces between lines, variable character spacing, presettable page headings, page numbering, and right and left margin justification using the Diablo's unique character spacing routines-no extra blanks are inserted in your text, nor is there any need for hyphenation. This potent system is available only at Computer Power & Light, 12321 Ventura Blvd., Studio City, CA or 7878 Clairemont Mesa Blvd., San Diego, CA. Four year lease plans and bank financing are available. Call (213) 760-0405 for more information.

**CIRCLE INQUIRY NO. 109** 

#### RCC Z/25 Fortran IV\*-Minifloppy\*\* Kit

The Z/25 FORTRAN IV\*-Minifloppy\*\* kit gives you several of the most wanted features in microcomputers today: The speed, convenience and reliability of a minifloppy disc; The convenience of a disc operating system, file management, text editor, and utilities; The power of a resident FORTRAN IV compiler. And you get all this plus an S-100 bus compatible floppy interface which is a flexible disc driver and parallel I/O module in one; tried and proven documentation; a 90 day warranty; and two year software update service.

The system is designed with industrial quality at a price the hobbyist can afford—\$1095 in kit form, \$1220 assembled and tested.

The kit features the proven Shugart SA400 Mini-floppy drive which packs a whopping performance into a cassette-sized package. The drive has been engineered with the same high quality proven technology packed into thou-

sands of larger disc drives. It is provided fully assembled and factory tested with complete Shugart documentation.

You get up to 65K of formatted programs and data packed onto a 5.25" square minidiskette\*\*. You get dependable data integrity—1 in 10° soft errors, 1 in 10° hard errors. Positive media interlock, write protect circuitry, glass bonded ferrite/ceramic head, and a positive positioning direct drive stepping motor actuator are standard.

For more information, contact Realistic Controls Corporation, 3530 Warrensville Center Rd., Cleveland, OH 44122, (216) 751-3158.

\*FORTRAN IV distributed in the U.S.A. under license from Unified Technologies of Canada.

\*\*Trademark of Shugart Associates

**CIRCLE INQUIRY NO. 110** 

#### **Vocal Input to Computer**

A system compatible with all S-100 bus computers to provide voice input and control, replacing keyboards in many instances, known as SpeechLab\*, is available in selected computer stores and directly from the manufacturer for \$249 in kit form or \$299 assembled and tested.



SpeechLab\* digitizes and extracts data from a speech wave form and applies pattern matching techniques to recognize the vocal input. Uses include computer input, games, research, and vocal control.

In addition to S-100 bus computers such as Sol, Altair, and Imsai, SpeechLab\* can be used with any computer with the aid of a separate power supply and connector.

Included in the price is a complete hardware/software system, a 275 page laboratory manual, 95 page hardware manual, high fidelity microphone, and three programs on paper tape. The lab manual is the only introductory volume on speech recognition currently available, according to the manufacturer.

Technically the system features 64 bytes of storage per spoken word and a vocabulary of up to 64 words in memory. Other features include real time response, 95% correct recognition, hardware self-test capability and advanced C-MOS design for low power and reliability.

Software includes SpeechBasic\* Basic programming language, assembly language speech recognition program, SpeechBasic plot, correlation, recognition, advanced recognition and hardware self-test programs.

For complete information, please address Heuristics, Inc., 900 N. San Antonio Rd., Los Altos, CA 94022, (415) 948-2542.
\*T.M. of Heuristics. Inc.

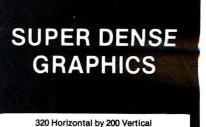
**CIRCLE INQUIRY NO. 111** 

#### Micro M16

Standard features of the Micro 16's CPU card include the PACE<sup>TM</sup> 16-bit CPU by National Semiconductor. EPROM Bootloader, with transparent load feature. 110 or 1200 Baud, 20MA loop TTY/Printer port. 9600 Baud EIA CRT port. Two 1200 Baud audio cassette ports, under program control.

Standard memory card features include full 16,384 word capacity (16 bit)—32K bytes on one board, using dynamic ram with transparent refresh.

M16's motherboard accommodates CPU,



Y Y=e-aXcob(2=X/b)

a=.81, b=42.86

IF YOUR COMPUTER
CAN'T SHILE (OR
PLOT) IT PROBABLY
HAS MERLIN DEFICIENCY
ANEMIA.

(EQUATION PLOTTED WITH BASIC)

The MERLIN Super Dense add-on kit provides maximum resolution at a minimum cost. In fact, MERLIN with Super Dense has more capabilities than any other S-100 bus video interface at any price!

Once you've seen 'Super Dense' graphic resolution you'll know there is nothing to compare it to . . . short of spending over \$600 . . . and even then you'll not have all of the capabilities of MERLIN with 'Super Dense'.

Super Dense provides true bitmapping. Each and every point on the screen is controlled directly by a bit in memory. (Requires 8K of system memory.)

ROM character-graphics looked good for a while; then came MERLIN's 160 by 100 bit mapping graphics; and now . . .

320 by 200 bit-mapping graphics!!!

If you're looking for a graphic display,
MERLIN with Super Dense is the best
there is. And if you hadn't considered
graphics or thought it was out of your
price range, consider what you could
do with 320 H by 200V graphics and for
only \$39 extra.

The Super Dense add-on kit to the popular MERLIN video interface is now available with off-the-shelf delivery.

M320-K, Super Dense Kit .....\$39 M320-A, Super Dense Assm. ..\$54 See MERLIN ad on previous page.

For information fast, write direct, or see 'Super Dense' at your nearest computer store.

MC and BAC accepted.

"See us in Boston"



**CIRCLE INQUIRY NO. 35** 

four memory cards, four I/O cards, plus optional programmer's panel card.

The serial/parallel I/O board provides among a host of standard features—two 16-bit parallel input and output ports, TTL compatible, and EIA serial communications port.

Add to these superior features the sheer physical beauty of M16's furniture grade cabinet of gunstock walnut veneer. It's a design piece to fit handsomely into any living room or den.

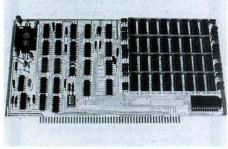
Then, too, there's the linking-relocating general loader, and cassette bootstrap loader which automatically locates the top of memory and relocates itself to the top of memory, enabling program loading from memory to location zero. During the process of locating the top of memory, a full memory test is made every time the load button is pressed.

M16's primary language is 8K PACE<sup>TM</sup> BASIC, as modified and extended by Micromega, with a host of features. For further information, contact Micromega Corporation, 11311 Stemmons Freeway, Suite 12, Dallas, TX 75229, (214) 231-4777.

**CIRCLE INQUIRY NO. 128** 

#### Altair 16K Memory Board Now Available

The Altair memory module provides 16K bytes of dynamic Random Access Memory. By implementing low power and fast access dynamic memory ICs, the Altair 88-16MCD runs at a maximum power dissipation of three watts and a maximum time of 350 nanoseconds.



Crystal-controlled logic timing eliminates the need for on-board one-shot multivibrator circuitry. This results in continuous operation without wait states for greater reliability.

Bus strips provide isolation between power

Bus strips provide isolation between power and signal lines for maximum noise suppression. Address selection is switch selectable in 4K blocks. Each board requires one slot on the Attair 8800 bus.

For further information contact MITS, Inc., 2450 Alamo S.E., Albuquerque, NM 87106.

**CIRCLE INQUIRY NO. 129** 

#### MODEL EIGHTY Head-per-Track Magnetic Disc Mass Memory

A large head-per-track magnetic disc mass memory—MODEL EIGHTY—is announced by Alpha Data Incorporated. The MODEL EIGHTY has a maximum capacity of 64 million bits (8 megabytes) with an average access time of 8.5 milliseconds.



The MODEL EIGHTY is compatible with all Alpha Data controllers for Data General and DEC computers. A simple change of one interface card permits emulation of other manufacturers' products.

A totally solid state CCDISCTM semiconductor disc memory covers the storage capacity range from 1 to 8 millino bits with average access time as short as 250 microseconds. It was designed to complement the Alpha Data rotating disc family.

Production MODEL EIGHTY disc memories are available twelve weeks ARO. Depending on specific model and OEM quantities, typical prices are \$3,000 to \$7,000. For more information contact Alpha Data Incorporated, 20750 Marilla St., Chatsworth, CA 91311, (213) 882-6500, TWX (910) 494-4914.

**CIRCLE INQUIRY NO. 130** 

#### Come Fly With Me

The PRD11 is a computer that's ready to fly when you are. A complete computer that utilizes the DEC's LSI-11 central processing unit and 56K bytes of RAM memory packaged in a 23 lb. suitcase configuration.



In addition to the CPU and RAM, the unit included provisions for multiple terminal interfaces, a mass memory interface and a data acquisition sub-system.

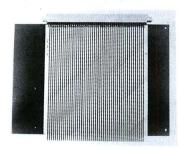
The PRD11 is shown above with a Computer Operations portable LINC Tape mass memory that is fully compatible with DEC's RT11 operating system. Software available includes full macro-assembler, FORTRAN IV, Multi-user BASIC. FOCAL and APL.

The PRD11 with 32K Bytes of memory and a serial line interface is priced at \$4,950.00. A typical system with 56K Bytes of RAM, fixed and floating arithmetic, serial I/O, Linc Tape mass memory, a Texas Instrument Model 745 portable printer terminal and RT11 operating system is priced at \$11,790.00. Delivery is 30 days. For further information contact RDA, Inc., 5012 Herzel Place, Beltsville, MD 20705, (301) 937-2215.

**CIRCLE INQUIRY NO. 131** 

#### Card Extenders Aid MC System Design and Debugging

A new circuit card extender is form and plug compatible with Altair 8800, IMSAI 8080, and other similar microcomputer CPU, memory, and interface boards. Designated the 3690-12, the extender facilitates out-of-chassis trouble-shooting and hardware debugging.



The 7.5-inch high by 9.99-inch wide extenders are fabricated of high quality 0.0625-inch thick epoxy-glass composite material. The two-ounce copper conductors are solder tinned while the card edge connectors are gold-flashed nickel plate for low con-

tact resistance and reduced wear. The mating receptacle has 100 contacts (50 each side) on 0.125-inch centers.

Unlike many extender board kits, the Vector 3690-12 is fully assembled, eliminating the tedious and time-consuming process of forming and attaching receptacle leads. In single unit quantities the 3690-12 is priced at \$25.00.

The Model 3690-12 is part of Vector's complete 3690 card extender series. The series consists of twelve extenders with heights from 6.5 inches to 11 inches and widths from 2.73 inches to 6.99 inches. Conductor strips range from 30 (15 each side) to 100 (50 each side) and extenders have contacts that mate with most common receptacles. The 3690 series prices range from \$6.75 to \$25.00. Bare extender cards without receptacles are also available. Delivery is stock from Vector and from Vector's authorized distributors. For further information contact Vector Electronic Company, 12460 Gladstone Ave., Sylmar, CA 91342, (213) 365-9661; TWX (910) 496-1539.

**CIRCLE INQUIRY NO. 132** 

#### Self-Study Microcomputer Training System

Integrated Computer Systems, Inc. introduces the beginner-oriented, 8080A-based "Self-Study Microcomputer Software/Hardware Training Course." With built-in keyboard and display, no expensive teletype or CRT terminal is required. Designed for use in the home or office, this course (No. 126) includes all system hardware, software and information best suited for learning to program and fully use an 8080-type microcomputer system. The 650-page Workbook/Text teaches 8080 instructions 1-by-1, programming, debugging and hardware interfacing through 33 Hand-on Exercises. Memory includes 512 bytes of CMOS RAM (maximum 1K on board) and 1K electrically erasable PROM. I/O ports for hardware experiments, cassette interface, etc. System Price: \$545.00 (power supply optional).



#### ICS Microcomputer Training System

Single-board microcomputer with 8080A 8-bit CPU, 512 bytes CMOS RAM, 1K EPROM, 24 bits of I/O including 2 serial ports, DMA channel for on-board 8-digit display and 25-key keyboard. Also free area for audio cassette, EIA or current loop interface circuits, analog to digital converters.

**Educational Monitor Program** 

The ICS Monitor Program (in factoryprogrammed PROM's) is specifically designed for easy use and efficient learning. Many monitor subroutines are available for use in your own programs including display and keyboard I/O, timing, cassette interfaces, etc. The monitor provides for loading your own programs, storing them on cassettes, running your program and debugging with single-step or breakpoint operation.

Microcomputer Training Workbook

650 pages utilizing features of the Training System and Educational Monitor to teach microcomputer software and hardware design techniques. *Discussion* of each 8080 instruction is complemented by simple exercises illustrating effective use. Teaches basic programming and progresses to advanced techniques including I/O interfacing.

For further information contact Integrated

Computer Systems, Inc., Self-Study Training Dept., 4445 Overland Ave., Culver City, CA 90230, (213) 559-9265.

**CIRCLE INQUIRY NO. 133** 

## Basic-E Manual and CP/M Software Available

CP/M is a disc operating system furnished with IMSAI and DIGITAL SYSTEMS floppies. CP/M owners are presently using BASIC-E — a compiling language written by Gordon cubanks — which provides disc random-access capability. There are several BASIC-E versions floating around, with decreasing bugs in more recent editions. A major problem for users has been the lack of adequate documentation.

JEM Company has produced a comprehensive BASIC-E manual, which explains, in detail, how to program in BASIC-E and how to exploit the capabilities which BASIC-E provides. This manual is available at a price of \$15.00.

manual is available at a price of \$15.00.

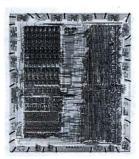
JEM Company also has available some essential CP/M software, which will be furnished on a floppy disc for \$60.00. Included on this disc is: the latest BASIC-E compiler and runtime monitor, which provides seven-significant figure precision; a BASIC-E formatting procedure, which produces user controlled automatic round-off, total and decimal field widths, and floating commas and dollar signs; a letterwriter and name file manager, which provides for entry of embedded words in the text; a file transfer facility that handles object files. (The CP/M Interchange usually messes up discs, if used for non-ASCII files); improved BASIC-E versions of several computer games, demonstrating BASIC-E procedures for cursor control and other techniques; a mortgage program that shows how BASIC-E can produce business type reports, using disc-file output techniques.

For further information contact John K. Jacobs, JEM Company, 2555 Leavenworth St., San Francisco, CA 94133, (415) 673-8962.

**CIRCLE INQUIRY NO. 134** 

#### Programmable Com-Interface for MP-Based Data Equipment

A Programmable Communications Interface (PCI) designed for 8-bit microprocessor serial communications is now available from Signetics.



Designated the 2651 PCI, the MOS/LSI circuit combines the functions of a Universal Synchronous/Asynchronous Receiver/Transmitter (USART) with those of a baud rate generator in a single 28-pin, dual-in-line package. It is the first such unit for microprocessor applications.

The 2651 will provide an extremely costeffective solution to many data communications problems in intelligent terminals, communications controllers, data concentrators, front-end processors, and similar applications.

Capabilities of the 2651 include modem control, support of IBM's BISYNC protocol, asynchronous echo mode, and local and remote self-testing. The chip is fully TTL compatible, operates from a single +5V supply, and does not require a system clock.

The 2651's straightforward addressing scheme makes it compatible with most 8-bit microprocessors, including the 2650, 8080, Z80, and the 6800.

The PCI is programmed to handle characters

from 5- to 8-bits in length. Three status pins have open-drain outputs to facilitate a wire or interrupt request input to the microprocessor.

The internal baud rate generator provides 16 different program-selectable baud rates for the transmit and receive clocks. These range from 50 to 19.2K bits per second. Alternatively, external baud rates may be selected and divided by one, 16 or 64 by an on-chip programmable divider.

In the synchronous mode, one of two SYNC characters may be programmed; received SYNC characters may be stripped; odd, even, or no parity can be selected; DLE characters can be detected, stripped, and DLE-SYNC used for transmitter underrun in transparent mode.

Asynchronous mode features include falsestart bit detection; 1, 1½, or 2 stop bits; odd, even or no parity selection; parity, overrun, and framing error detection; break generation and detection; and automatic serial echo (receive and retransmit) mode. Price is \$13.70 in 100 quantities.

For further information on the new Programmable Communications Interface contact Signetics, 811 East Arques Ave., Sunnyvale, CA 94086, (408) 739-7700.

**CIRCLE INQUIRY NO. 135** 

#### Top Performance IC FET or Amp Lowers Cost as Much as 50%

A new IC FET-input op amp, the 3527, provides combined input drift, offset and bias current specs equivalent to the best FET-input op amps now on the market, but at a significantly lower price.



Three grades are available, with the premium 3527CM delivering input offset voltage drift less than  $\pm\,2\,\mu\text{V}/\,^{\circ}\text{C}$ , offset less than  $\pm\,250\,\mu\text{V}$ , and bias current less than 5 pA. Maximum specs for the AM version are  $\pm\,10\,\mu\text{V}/\,^{\circ}\text{C}$ ,  $\pm\,500\,\mu\text{V}$ , and 5 pA; the BM maximums are  $\pm\,5\,\mu\text{V}/\,^{\circ}\text{C}$ ,  $\pm\,250\,\mu\text{V}$ , and 2 pA.

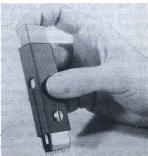
In addition to the above specs; the 3527 is free from latch up, is short circuit protected for continuous shorts to common, is internally compensated for unity-gain stability and has a low input noise spec (2.6 µV pp, 0.1Hz to 10Hz).

For more information, contact Dennis Hynes, Product Manager, Burr-Brown, International Airport Industrial Park, Tucson, AZ 85734 (602) 294-1431.

**CIRCLE INQUIRY NO. 136** 

#### "The Little Dipper"

The Little Dipper (No. 4490 Dip Inserter) speeds DIP insertion. Speeds of up to 1000 devices per hour have been reached on production lines with minimum operator fatigue.



Pick-up is made near the tips of the leads, with

# ZAPS

OPERATING SYSTEM

Programming in machine code is alright, but if you want to do super-fast graphic programming with your MERLIN, the ZAPS assembler, editor, and cassette file operating system package will open doors for you.

Start by entering your program or other textual material using the ZAPS editor, a complete text editor like you might find on a large time-sharing system. No retyping entire lines!

Then assemble your 8080 or Z-80 program with the assembler without reloading tapes. The entire package is resident and runs in an incredibly small 13K. Variable names and labels can be any length!

Now run your program, perhaps taking advantage of some of the callable operating system facilities.

#### ZAPS features include:

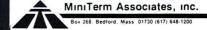
- ☆ 8080/Z-80 compatible with genuine Zilog mnemonics
- ☆ CRC checks on all tape operations
- ☆ Selectable hex, octal, decimal, or binary base.
- ☆ Easily adaptable I/O structure
- ☆ Complete 90-page manual with examples
- ☆ Supplied on MiniTerm/Tarbell compatible tape
- ☆ Developed and supported by Algorithmics Inc.

For only \$60, ZAPS will significantly magnify the power of your computer. ZAPS is shipped from stock. Start building those starship programs today.

For more information fast, write direct. Dealer inquiries invited.

MC and BAC accepted.

"See us in Boston"



CIRCLE INQUIRY NO. 36
INTERFACE AGE 113

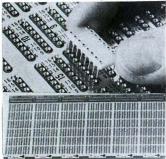
no stress to the body of the device. The tool brings leads to correct spacing for ease in P.C.B. insertion. The Little Dipper holds firmly and ejects easily. It can be used with all standard magazines as well as with flat trays and surfaces. Screw provides adjustment for various packages. Overall length is 4 inches.

For further information, contact Techni-Tool, Inc. Apollo Road, Plymouth Meeting, PA 19462, (215) 825-4990, Order Dept. 800-523-7798.

**CIRCLE INQUIRY NO. 112** 

#### PG Series Wire Wrap Panels

Designed for fully automatic, semiautomatic or hand wire wrap interconnection, EECO PG series panels feature 2 ounce copper circuitry, solder-coated on both ground and Vcc planes. Available panel sizes can hold from 30 to 180 sixteen pin ICs.



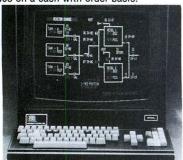
Both power connected and custom power panels are available. The large ground and Vcc plane areas provide excellent wiring impedance control for high speed logic applications. When the logic requires, there is provision for power by-pass capacitors. Three different I/O connector area patterns are available. The socket terminals are beryllim copper, gold over nickel plated, and provide a low contact resistance, "gas-tight" connection with the ICs. Panels are available with either 2-level or 3-level WW pins.

The largest board size (six pattern) is 7.475" (189,87 mm) by 16.175" (410,85 mm). Single unit price for this size board starts at \$243.25; delivery is from stock. EECO, 1441 E. Chestnut, Santa Ana, CA 92701, or phone "EPP Products" (714) 835-6000.

**CIRCLE INQUIRY NO. 113** 

#### Intercolor 8001 8-Color CRT and 8051 Desk Top Computer

The 8001 is an intelligent 8-color CRT Terminal. It comes complete with RAM refresh memory, 8080 CPU, Terminal control software, Keyboard, 19 inch 8-color CRT, RS 232C I/O, and selectable Baud Rate to 9600. Numerous options are available for upgrading the Intercolor 8001. Prices range from \$2,295 for 1-9 units to \$1,495 for 100 or more units. A single Evaluation Unit can also be purchased for \$1,495 on a cash with order basis.



The Intercolor 8051 Desk Top Computer is a stand alone microcomputer system. It comes complete with Floppy Tape Memory, BASIC language, 8080 CPU, 8-color CRT, selectable Baud Rate to 9600, 31 ports with two RS 232C Channels, Keyboard with Cursor and color cluster, Background color, Lower case ASCII characters, 27K of memory expandable to 64K, Roll, Insert/Delete, 48 line x 80 Characters/line,

2X Character height, and a graphics mode with 160X 192 elements. Price is \$3,995, complete.

For further information, contact Intelligent Systems Corp., 5965 Peachtree Corners East, Norcross, GA 30071, (404) 449-5961.

**CIRCLE INQUIRY NO. 114** 

## First Floppy Disc Drive with Built-in Controller, Formatter

The first floppy disc subsystem with built-in controller/formatter that eliminates the need for separate controller hardware and associated cables was introduced by the Microsystems Division of Pertec Computer Corporation.

tems Division of Pertec Computer Corporation.

The Intelligent Floppy<sup>TM</sup> incorporates a single circuit board within the disc drive chassis, eliminating the need for a separate controller and much of the associated procesor-based software usually required to operate a floppy disc drive on a microprocessor.

The Unit, designated the iCOM® Model FD5200 Intelligent Floppy<sup>TM</sup>, uses a simple 8-bit bi-directional bus that enables the system manufacturer to incorporate easily a floppy disc capability into his system. The result is a significant reduction in hardware cost, size, assembly time, and software development.

The FD5200 drive uses a conventional 8-inch diskette. The mechanics of the unit are based on Pertec's FD511 Flexible Disc Drive unit and disc formatting is to the IBM 3740 standard, yielding a capacity of 256K bytes of data per diskette. Other soft-sectored formats may be selected by the user.

The heart of the internal formatter/controller is a special LSI floppy disc controller chip. The single formatter circuit board can per-

The single formatter circuit board can perform an extensive amount of complicated logic needed to write data on a diskette in the IBM 3740 format. Also, the control section of the Intelligent Floppy is set up to perform track seek and verify automatically without the intervention of the host processor.

The Intelligent Floppy is expected to provide easier system maintenance and improved reliability over that of many other floppy disc subsystems through modular replacement of the controller/formatter board and because the smaller component should statistically reduce failures.

The new floppy disc can operate with any 8 or 16-bit microprocessor and can also easily interface to a minicomputer. The built-in formatter has the capability to format or initialize a blank diskette as well.

The unit shares the features of the high performance, field-proven Pertec FD511 Flexible Disc Drive. The resultant FD5200 unit thus provides write protect, automatic CRC generation and verification, and automatic unloading of both the read/write head and the head pressure pad. The latter feature is unique to the Pertec drives and serves to optimize diskette life.

The FD5200 also shares the FD511 3-stepper-track head positioning scheme. Other floppy disc drives move the head positioning lead screw in one step per track. Pertec's method of stepping three times to locate each track significantly enhances track positioning accuracy and data reliability.

The built-in controller is ideal for many stand alone applications such as intelligent terminals, but it also offers new capabilities for multiprocessing in some systems. The reduced cost of the FD5200 permits designers to consider using several FD5200s rather than a single shared formatter/controller. The approach will make possible not only overlapping head seeks, but also overlapping reads and writes that cannot be achieved at all with a shared formatter/controller. This, in turn, should permit the designer to achieve optimum throughput and more efficient total system operation, at only slight extra cost.

The single unit price of the FD5200 is less than \$1000. The price is under \$700 in small OEM quantities. Orders for sample quantities are being taken now, with full production expected in the 4th quarter of 1977.

For further information about the new iCOM



#### **DEALERS**

ARIZONA PHOENIX Byte Shop of (602) 942-7300

TEMPE Byte Shop of (602) 894-1129

TUCSON Byte Shop of (602) 327-4579

CALIFORNIA COSTA MESA Orange County Computer Center (714) 646-0221

LAWNDALE Byte Shop of (213) 371-2421

PALO ALTO Byte Shop of (415) 327-8080

PASADENA Byte Shop of (213) 684-3311

SAN DIEGO Computer Center (714) 292-5302

SAN RAFAEL Byte Shop of (415) 457-9311

TARZANA Tech Mart (213) 344-0153

COLORADO DENVER Computer Hut (Prime Radix) (303) 573-4895

FLORIDA CORAL GABLES Sunny Computer Co. (305) 661-6042

ILLINOIS CHAMPAIGN Champaign Computer Co. (217) 359-5883

EVANSTON Itty Bitty Machine Co. (312) 620-5808

INDIANA BLOOMINGTON Data Domain (812) 334-3607

MARYLAND ROCKVILLE Computer Workshop (301) 488-0455

MASSACHUSETTS WALTHAM The Computer Mart of Boston (617) 899-4540 NEW JERSEY ISELIN The Computer Mart of New Jersey (201) 283-0600

NEW YORK NEW YORK The Computer Mart of New York (212) 686-7923

OREGON BEAVERTON Byte Shop of (503) 644-2686

EUGENE Real Oregon Computer (503) 484-1040

PORTLAND Byte Shop of (503) 223-3496

TEXAS HOUSTON Electronic Specialty Co. (713) 665-0477

LUBBOCK Computer Mart of W. Texas (806) 797-7550

RICHARDSON The Micro Store (214) 231-1096

UTAH SALT LAKE CITY Byte Shop of (801) 355-1041

WASHINGTON BELLEVUE Byte Shop of (206) 746-0651

WISCONSIN MILWAUKEE The Milwaukee Computer Store (414) 259-9140

AUSTRALIA GORDON N.S.W. Trudata Pacific 4985706

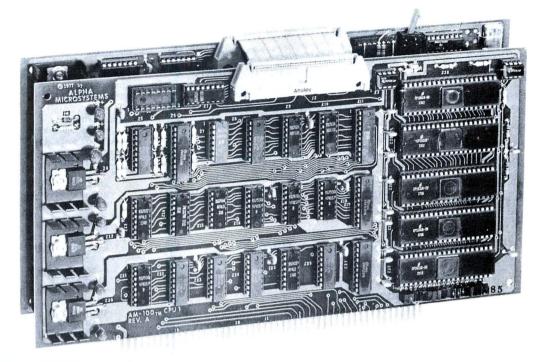
CANADA TORONTO The Computer Place (416) 598-0262 OTTAWA Focus Scientific (613) 236-7767

GERMANY MUNICH Datameg KG (089) 460-4993

SPAIN BARCELONA Infotecnos (000) 235-7110

114 INTERFACE AGE

# **ALPHA MICROSYSTEMS AM 100**



#### AM-100\* 16-BIT CPU

The AM-100\* by Alpha Microsystems replaces your 8080 microprocessor in the S-100 bus computer with a 16-bit microprocessor CPU (2 card set) that gives you Minicomputer power.

- Eight 16-bit multipurpose registers
- · Multi-level DMA and vectored interrupt
- Real-time clock on the CPU board.
- Hardware supported totally relocatable object code.
- Multi-user multi-tasking timeshared operating system.
- priority system in time-sharing • True operations.
- Multi-user structured file system with passwords.
- · Multiple pass macro assembler and linking loader.
- Floppy disk file management system and
- Up to 10 times the throughput of an 8080 system
- Fully supports most S-100 peripherals
- without modification.

   AlphaBasic\* extended compiler and runtime system (not an interpreter).
- Free-form text editor and letter-writing text formatter.
- System generation program to create custom operating system monitors.
- Completely device independent with logical file I/O calls.

#### AM-200\* FLOPPY DISK CONTROLLER

The AM-200\* is an S-100 bus compatible floppy disk controller, providing DMA facilities and capable of formatting disketes. Alpha Microsystems has implemented the Western Digital FD1771 controller chip on this product. This controller is probably the most advanced floppy disk controller in the micro market today.

## AMOS\* The ALPHA MICRO OPERATING SYSTEM

Hardware limitations of the 8 bit machine have made microcomputer timesharing impractical for the small system user. The AM-100\* 16 bit microprocessor set imple-

mented with AMOS\* puts at your command a system which easily accepts multi-tasking from a multiple user structure. In addition the AM-100\* system lets you control priorities and allocate memory requirements for each job activated. Log and password facilities provide a security system to prevent unauthorized or restricted access to data and program files.

- Businessmen put a terminal on the desk of your bookkeeper, stock clerk and sales department. Perform the daily accounting, inventory control and sales functions at the same time. Place a terminal in the shop and audit production schedules with the processor's real-time clock.
- Teachers have a number of students each at his own terminal running different learning programs at the same time. Monitor the progress on your master
- Computer Stores/Amusement Parks set up a game bank with one computer and several terminals. Have different games on each screen.

The AM-100\* is based on Western Digital's advanced WD-16 microprocessor. It has been microprogrammed to inhance the software of the operating system, languages, and utility programs. The microprocessor includes hardware floating point arithmetic giving the AM-100 throughput speed matching many minis.

#### S-100 BUS COMPATIBILITY

This 16 bit processor system interfaces to the popular S-100 8 bit bus by an advanced multiplexing method. This multiplexing function is totally transparent to the user. Most standard S-100 compatible products are supported by the AM-100\*

#### **ALPHABASIC\* COMPILER**

The AlphaBasic language is implemented as a compiler as opposed to the more popular interpreters. It reads the source code statements and generates a compacted and fully resolved object code program. This object code program is then executed by a special runtime package. The compiler, the runtime package, and the

compiled code are reentrant and may be shared by several users at the same time. The source code is not required to be present during the execution thereby reducing memory requirements.

#### PROGRAM DEVELOPMENT SYSTEM

- · Milti-pass assembler supports full nested macros and conditional assembly.
- Assembler supports global inter-program
- Assembler supports global inter-program symbols with a linking editor to create a concatenated runnable program file.
   Assembler and operating system both support segmentation so that large programs. grams may be run as a series of smaller segments that overlay each other
- Debugging program operates symbolically so that octal or hex conversions are not necessary.
- · Text editor is free-form string oriented with commands to manipulate data in both the line and character modes.
- · Letter writing text formatter allows automatic margin and paragraph calculations for formatted documentation.

#### GENERAL SOFTWARE POLICY

Alpha Microsystems continues to improve its software libraries and from time to time makes new releases of its software. Purchasers of the AM-100 will be provided with such updates as they occur at a nominal charge.

\*Trademark of Alpha Microsystems

Write or call us for the location of your nearest Alpha Microsystems dealer.

See dealer listing on opposing page.



17875-N Sky Park North Irvine, California 92714 Phone: (714) 957-1404

# TECH-MART

Offers a Low-Price Sixteen Bit Disk Oriented Multi-User System with Floating Point Basic Compiler, a True Text Editor, etc. that plugs into the S-100 Bus. You cannot beat AM-100 Cost/Performance Ratio. Besides, we offer many other systems and products to suit your needs.

Assemble 22 Card Mother Board IMSAI 8080 for \$855.00. Dealer inquiries invited.

Classes offered in hardware design analysis and debugging.

We Are Open Six Days a Week Monday-Friday 10 A.M. to 9 P.M. Saturday 9 A.M. to 6 P.M. Sunday Closed

CALL US AT: (213) 344-0153

#### **TECH-MART**

19590 Ventura Boulevard, Tarzana, CA 91356

CIRCLE INQUIRY NO. 81

Intelligent Floppy<sup>TM</sup> disc drive with built-in controller/formatter contact Microsystems Division of Pertec Computer Corporation, 6741 Variel Avenue, Canoga Park, CA 91303. (213) 348-1391.

**CIRCLE INQUIRY NO. 115** 

#### Microcomputer Builders' Catalog

Computer Warehouse Store announces the availability of its 48-page catalog for personal computing enthusiasts and small systems users. It explains five different microcomputer kits and an abundance of 90-day warranteed used peripherals such as CRT terminals, keyboard/printer terminals, video monitors, tape drives, disc drives and printers. Since it is the only such catalog available in the microcomputing field, it marks the beginning of "Mail-order computers" and alleviates hardware and information inaccessibility that has caused problems for many computerists in this field.

"All About Hobby Microcomputer Systems," a special report featured in the catalog, provides pertinent information of concern to all computerists — from novice to sophisticated hacker. It tells what to look for in selecting a microcomputer system (Data width, addressing capacity, and instruction set, for example), micro alternatives (homebrews, kits and assembled systems), basic system considerations and system versatility through expansion.

A microcomputer comparison chart reviews, among other details, price, features, software, configuration & system components of most popular micros such as National Semiconductor's SC/MP, Intersil's Intercept Jr., MOS Technology's KIM-1, Southwest Technical Products 6800 and IMSAI's 8080A. It is a valuable tool for "comparison shopping" to the computerist.

The book section is a highlight of the catalog, with review of over 150 books . . . the largest selection ever assembled of computer titles, with everything needed to keep the computerist informed about new trends in micro-

computing: Software, hardware, languages, etc. And every book is in stock.

Computer Warehouse Store has put together unique packaged systems that are tailored to the needs of computerists . . . from novice to professional. For \$649, those just entering the field can purchase a "U-Built-It-System" - a 'Barebones' CRT Terminal, offline storage and microprocessor development system. At \$1499, Computer Warehouse Store offers a built "Economy System" that com-bines the features of an ASR33 type teletypewriter with an 8K 6502 microcomputer for small systems software development requiring a universal peripheral device with paper tape I/O and hard copy. \$4699 (kit or \$6299 (built & tested) will buy "The Professional Microcomputer System," a floppy disc based system designed for busines or scientific application requiring high density, off-line storage, standard CRT terminal (24 lines x 80 characters) and high speed hard copy.

Computer Warehouse Store, a division of American Used Computer Corporation, is the only personal computing store to offer such a wide range of used peripherals so that the computer can cost effectively put together versatile and effective complete systems at the best possible price.

The Catalog is slated to be printed twice a year and it will offer the best available used peripherals to computerists. The ability of Computer Warehouse Store to offer this equipment is because of large volume buying and the resources and contacts of the parent company.

The catalog is available for \$1 from Computer Warehouse Store, Dept. C, P.O. Box 68, Kenmore Station, Boston, Mass. 02215, (617) 261-1100.

**CIRCLE INQUIRY NO. 116** 

#### Power Supply for KIM-1

The Micro Technology Unlimited K-1000 Power Supply is especially designed to power

the popular KIM-1 Microcomputer Board and its optional 4K Expansion Memory Module. The Power Supply follows the same preassembled, tested, and burned in "plug-N-go" philosophy as the KIM. The power supply is totally enclosed in a black bakelite box which measures 5%" wide by 61%" long by 21%" high overall. The line cord and output terminal strip are hidden under the box which is supported on rubber feet. The aluminum bottom plate serves as a heat sink and is at ground potential. An internal 1 amp fuse protects against component failure and shorts to the unregulated outputs. The regulated outputs have both internal current limit and thermal shutdown.

#### Specifications:

- Line Voltage Range: 110 to 125 volts 60 Hz AC. Lower input voltages may be accommodated by suitable output current derating.
- Output Voltages:
  - +5 volts regulated ±5% cumulative tolerance due to line and load variation, ripple, and static regulator tolerance. Maximum load current 1.2 amps.
  - + 12 volts regulated ± 3% cumulative tolerance due to line and load variation, ripple, and static regulator tolerance. Maximum load current 100 MA.
  - +7.5 volts unregulated tolerance +7 to +12 as a result of line and load variations. Maximum load current 750 MA. This output is provided for powering a KIM-2 4K Memory Board or future MTU products for the KIM.
  - + 16 volts unregulated tolerance + 14 to + 20 as a result of line and load variations. An external capacitor to ground must be provided if any current is drawn from this terminal. Maximum load current with a 1000μF 25 volt capacitor is 250 MA. This output is provided for powering future MTU products.
- Packaging: Totally enclosed no protruding fins — no exposed wires. Bakelite Case with aluminum base plate. Line cord enters through bottom plate. Output to a barrier terminal strip for easy connections on the bottom.
- Ambient temperature: 0 to + degrees C.
- Price: \$40.00.
- Weight: Approximately 2½ pounds.

For further information, contact The Computerist, P.O. Box 3, S. Chelmsford, MA 01824, (617) 256-3649.

CIRCLE INQUIRY NO. 117

## Upgrade Kit for Motorola Evaluation Kit 2 Microcomputer

Microware Systems Corp. has introduced the DA1 upgrade kit designed to convert the popular Motorola MEK6800D2 evaluation kit to a terminal-based microcomputer system. The kit provides all circuitry necessary to interface the evaluation kit to any RS-232 compatible computer terminal. The interface is built on a small circuit board that fits over part of the D2's prototype area. The kit also contains the Microware RT/68MX advanced operating system preprogrammed ROM that replaces the existing keypad/LED display monitor ROM.

The RT/68 ROM has program development and debugging features that allows the terminal user to examine and change memory locations or MPU registers, insert and remove program breakpoints, dump blocks of memory on the terminal, and read or write tapes using the evaluation kit's built-in audio cassette interface. RT/68 also includes a powerful real-time operating system that can support up to 16 concurrent programs. The ROM is compatible with the wide variety of programs written for Motorola's MIKBUG monitor including assemblers, editors, and BASIC interpreters available from a number of sources.

The DA1 kit is priced at \$69.95 in single quantities. A comprehensive applications and programming manual is supplied with the kit including a source listing of the RT/68 ROM.

For more information, contact Microware

Systems Corp., P.O. Box 954, Des Moines, IA 50304. (515) 279-9856.

**CIRCLE INQUIRY NO. 118** 

#### New EICO Model 1200 Frequency Counter also Functions in "Period" and "Count" Modes - Optional Prescaler Extends Range to 250MHz

The EICO 1200 is a full six-digit frequency counter that also functions in a period and count modes. It features built-in input attenuation and 12 volt operation for mobile use. Outstanding accuracy and precision is assured by the IC digital circuit design and a stable 10 MHz crystal-controlled oscillator.



In the frequency-measurement mode, the 1200 is guaranteed to 30MHz (up to 250MHz with the EICO Model FE-250 Frequency Extender) with a resolution of 1Hz. Sensitivity is a low 15mV RMA to 30MHz, 50mV below 50Hz. The period mode measures intervals up to 9.99999 seconds. Using the milliseconds. This mode permits low-frequency measurements with high accuracy. This mode permits low-frequency measurements with high accuracy. Put the time base switch on ms and the mode switch on PER. Then solve the equation f= 1/period, using the displayed value! The

count mode adds event pulses to a count of 999999. Push the reset button and the count starts at zero. An inhibit signal, applied through a rear-panel terminal, stops the totalize mode at any time without loss of the displayed count. Should the number to be displayed exceed the 1200's capability, an overrange indicator lights. A gate lamp flashes to indicate an updated display. Suggested user net: \$169.95, Optional EICO FE-250 Prescaler: \$39.95. For further information contact Eico Electronic Instrument Co., Inc., 283 Malta Street, Brooklyn, N.Y. 11207.

**CIRCLE INQUIRY NO. 119** 

#### **Argus A 3000 Controller**

The first in a series of Magnetic Tape Cartridge controllers, the A 3000 Controller is the single PC board controller, formatter, and interface designed for easy system integration of the 3M DCD-3 Magnetic Tape Cartridge Drive and microcomputer systems using the popular S-100 bus structure.

The plug-compatible A 3000 Controller generates and reads proposed ANSI/ECMA compatible tapes. It features a 256 or 1024 byte buffer that liberates the host while the controller performs read/write operations. Read after write bit-for-bit data verification within the A 3000 controller relieves the host from reading and checking data. Software support is available for operation and diagnostics. Operational software is either Argus or user implemented in 2708 type PROMs inserted in resident sockets. CRCC (cyclic redundancy check characters) are generated and checked. Command and status signals found in high cost reel-to-reel tape systems are provided by Argus.

A system consisting of the Argus A 3000 Controller and 3M DCD-3 Tape Drive offers a serious challenge to floppy disc systems on cost as well as reliability, interchangeability, and protection of data. The tape system is pric-

# KIT BUILDERS Div. Marine Electronics International Corp.

- Fast Professional Construction
- Competitive Prices
- Debugged & Tested on our Mainframe & Terminals
- Assembly supervised & tested by Licensed Technicians



#### **BUY ANYWHERE**

Take your best shot, get the best price — send your kit to us for construction. **KIT BUILDERS** will start immediately and complete your computer, terminal and memories usually within 10 days of receipt. Completely test your device and then provide you with printouts of the test routines.

**KIT BUILDERS** occupies 10,000 sq.ft. facilities in S.E. Ft. Lauderdale convenient to the Airport and Port Everglades.

**KIT BUILDERS** is fully insured against loss of your equipment during construction and testing.

**KIT BUILDERS'** parent company has been established since 1958, building and repairing sophisticated navigation equipment. We are members of the Ft. Lauderdale Chamber of Commerce.

Call, write or TWX today for prices, appointments and deliveries (305) 525-3478 TWX 510-955-9484

#### KIT BUILDERS

1525 SE 16th Street Ft. Lauderdale, Florida 33316

# the BYTE SHOPS of South Florida

**WE OFFER:** IMSAI, Processor Tech, Vector Graphic, Tarbell, Seals, Compucolor, North Star, Apple, Oliver Audio, SWTP, iCOM, Synetic Design, Micro-Term, Vector, AT, Dynabyte, Cromemco, Scientific Research and more.

**BOOKS, DIAGRAMS, SOFTWARE:** We carry more than a complete library to answer your every need.

**SUPPOSE YOU NEED A SYSTEM?** We have specialists waiting to help you. They can design a system for most anyone. In addition, we have classes and workshops to help you keep pace with this expanding industry.

Open 10-6 Daily & Saturday 10-9 Thursday

BYTE SHOP 7825 Bird Road Miami (305) 264-2983 Dial 264-BYTE BYTE SHOP 1044 E. Oakland Park Blvd. Fort Lauderdale (305) 561-2983 Dial 561-BYTE ed at approximately \$0.077 per kilobit versus \$0.221 per kilobit for a comparable floppy disc system. For more information please address Argus Technology Corporation, 7900 Quimby Ave., Canoga Park, CA 91304, (213) 989-3503.

**CIRCLE INQUIRY NO. 120** 

#### **New PMI Application Notes Free**

Precision Monolithics, Inc., has published a new application note, "Exponential Digitally Controlled Oscillator Using DAC-76." The application note describes an oscillator with a 8159 to 1 frequency range covering 2.5Hz to 20KHz. An exponential, current output IC DAC functioning as a programmable current source alternately charges and discharges a capacitor between precisely-controlled upper and lower limits. This circuit features instantaneous frequency change, operates with +5V ± 1V and -15V ± 3V supplies, and provides monotonic frequency changes over a 78dB range — the dynamic range of a 13-bit DAC.

A complete schematic, parts list, timing diagram, and table of frequency response accompany the detailed theory of operation. An appendix gives timing equation derivations.

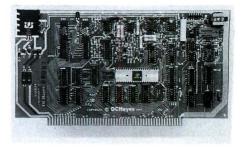
For a free copy of An-20, call Yolanda Dodson at (408) 246-9222 or write to: Precision Monolothics, inc., 1500 Space Park Drive, Santa Clara, CA 95050.

**CIRCLE INQUIRY NO. 121** 

#### 80-103A Data Communications Adapter

The 80-130A Data Communications Adapter was developed to function as an S-100 bus compatible serial interface incorporating a fully programmable modem and Telco interface. These functions are usually accomplished by the use of two separate modules: 1) a serial I/O board, and 2) an external modem. By combining these features on a single board, the

80-103A can offer microcomputer applications significant cost/performance advantages over other implementations.



An S-100 bus computer such as the Altair<sup>TM</sup> or Imsai, and a Telco 1001D data access arrangement (DAA) is all you need to control the Adapter and interface to the world-wide dial telephone network. These capabilities bring high powered features to hobby and business applications usually associated with the most sophisticated computer networks and do so at a very low cost.

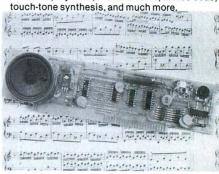
While software subroutines are provided with the modem, the programmer will find the architecture of the 80-103A extremely simple and programming a straight forward exercise. This device was specifically developed to increase the power and usefulness of microcomputer systems and is now available for your use.

For further information, contact D.C. Hayes, P.O. Box 9884, Atlanta, GA 30319.

**CIRCLE INQUIRY NO. 122** 

#### S-100 Bus Compatible Music Board

Newtech Computer Systems' low-cost Model 6 Music Board enables anyone with an S-100 bus computer to produce music and sound effects. Applications include generating melodies, rhythms, sound effects, Morse code, touch tone synthesis and much more.



The Newtech Model 6 S-100 bus compatible Music Board comes fully assembled and tested. Its features include selectable output port address decoding, a latched 6-bit digital-to-analog converter, audio amplifier, speaker, volume control and RCA phono jack for convenient connection to your home audio system. It employs a glass epoxy printed circuit board with plated-through holes, gold-plated fingers and top quality components.

A complete Users Manual, supplied with the Model 6 Music Board, includes a BASIC Language program for writing musical scores and an 8080 Assembly Language routine for playing them.

The price of the Model 6 Music Board is \$59.95 through computer stores. Delivery is currently from stock. For information contact your local computer store, or write to Newtech Computer Systems, Inc., 131 Joralemon St., Brooklyn, New York 11201, (212) 625-6220.

**CIRCLE INQUIRY NO. 123** 

#### Three New Printers at NCC Dallas

The introduction of three new computer printer families heralding "a new era in printers" has provided the focal point for Dataproducts Corporation's participation in the 1977 National Computer Conference.

# Disc/3

## COMPUTER SUPERMART

#### **COMPLETE BUSINESS SYSTEMS**

Accounts Receivable, Mailing Labels, Accounts Payable, Payroll, General Ledger, etc. on microcomputers and multi-terminal minicomputers. Call DISC/3, your proven turnkey software specialists for over 3 years, for complete system information. DISC/3 also supplies state-of-the-art business printers.

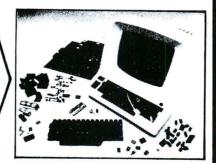
#### **DEALER INQUIRIES INVITED**

#### EASY TO ASSEMBLE

Lear-Siegler ADM-3 terminal kit with NEW DCA (direct cursor addressing) 24 lines x 80 characters; 64 ASCII upper characters, plus punctuation and control; 5 x 7 dot matrix; EIA standard RS232C and 20mA current-loop (switch-selectable).

\$749.95\* with DCA

CITY



Look to DISC/3...authorized distributors for IMSAI, Lear-Siegler, Cromemco, Z-80, Centronics Data Computer, Digital Equipment Corp., Data General Corp., TDL, and ICOM.



DISC/3 1840 Lincoln Blvd., Santa Monica, Calif. 90404 Store Hours — Monday-Friday 8:30-5:30 \*Prices subject to change.

| RUSH ORDER FOR                | M — or Cal | I Disc/3 (213) 45 | 1-8911                 |
|-------------------------------|------------|-------------------|------------------------|
|                               | KIT*       | ASSEMBLED         | TOTAL                  |
| ADM 3-K with DCA (24 x 80)    | \$749.95   | \$895.00          |                        |
| IMSAI 8080 microsystem        | \$599.95   | \$899.95          |                        |
| Box of 10 Diskettes (IBM Com  | patible)   | \$ 45.00          |                        |
| Californians please add sales | s tax      |                   |                        |
|                               | Signature_ |                   |                        |
| □ BankAmericard No            |            |                   |                        |
| ☐ Master Charge No            |            | Expires           | i                      |
| RANKAMERICARD NAME            | AD         | DRESS             | we honor master charge |

STATE

Each of the new products is the first in a new family of printers. Together, they represent a downward thrust into new application areas of the computer printer market. They use many engineering innovations to provide low-cost, high-performance capabilities that are particularly useful for low- and medium-speed applications in small business systems, remote intelligent terminals, distributed processing systems, and word processing systems.

The new printers are:

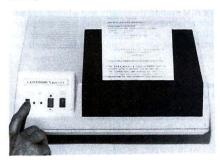
- The B-180 and B-300 line printers, which use Dataproducts patented Mark V hammer system and a refined steel band font carrier to offer print speeds up to 180 and 300 lines per minute, respectively;
- The M-200 impact matrix printer, which uses a new dual-dolumn 14-wire head and improved head wire guidance system to achieve a print throughput of 200 lines per minute in a bidirectional mode;
- The T-80 thermal matrix printer, which uses a unique print head to provide 80 characters per second print capabilities at the cost of an ordinary 30 cps printer.

The company also displayed its recently introduced Tempest printer line, its family of core memory products, new printer ribbon cassettes, and a variety of printer components — including the Mark IV hammer systems. For further information, contact Dataproducts Corporation, 6219 De Soto Avenue, Woodland Hills, CA 91364, (213) 887-8000.

**CIRCLE INQUIRY NO. 124** 

#### \$595 High Speed Microprinter

Centronics Data Computer Corp. (NYSE) has introduced a high speed, low cost, compact microprinter for \$595. Aimed at the home, hobby, and microprocessor markets, the 240 character-per-second Micro-1 is offered as a complete unit including case, power supply, 96 character ASCII generator and interface, paper roll holder, low paper detector, bell, and multiline asynchronous input buffer.



The microprinter produces copy on aluminum coated paper by discharging an electric arc to penetrate the coating, which is less than one micron thick. Toners and ribbons are not required.

The printed characters, unlike those resulting from thermal printing, are impervious to light, temperature, and humidity. In addition, the finished printed page may be reproduced on any office copying machine.

The microprinter electronics allows the machine to produce copy at a rate of 180 lines per minute on 4¾ inch roll paper and provides the user software selection of 20, 40, or 80 columns. Initial deliveries are slated to occur during the last calendar quarter of 1977. For further information, contact Centronics Data Computer Corp., Hudson, New Hampshire 03051, (603) 883-0111.

**CIRCLE INQUIRY NO. 125** 

# The Pennywhistle 103 A Professional Quality Modem in Kit Form

The Pennywhistle 103 Acoustic Coupler is the first professional quality modem available

in kit form. The Pennywhistle may be used either as an acoustic coupler (with the telephone handset) or it may be wired directly into the telephone via a DAA. In either case, the modem will operate in both the half-duplex (unidirectional) or full-duplex (bidirectional)



The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and it is able to communicate directly with another modem and terminal for telephone "hamming" and communications for the deaf. It is free of critical adjustments and is built with non-precision, readily available components.

One of the most significant problems associated with modems is that there is often difficulty in determining the difference between a signal of the proper frequency and one of its harmonics. The Pennywhistle 103, however, employs a *three-stage* active filter which prevents noise and harmonics from getting through.

The Pennywhistle kit includes everything needed to build the entire unit. All electronic components mount on a single 5" x 9" printed circuit board. The kit also includes all chassis parts, speakers, speaker grilles, muffs and line



# NORTH STAR OWNERS

## The System Executive Package You Have Been Waiting For:

- ★ EDITOR: Line oriented with auto number, incrementing to any value; holding up to 6 files in memory.
- ★ MONITOR/EXEC: Tape I/O in TARBELL & ESP formats (object or source); disk I/O for NORTHSTAR, reads HEX paper tape in INTEL
- ★ ASSEMBLER: Processor technology ESP compatible; assemble the program for one address & put object elsewhere.
- ★ DEBUGGER: Breakpoint continue from breakpoint & resume execution - reset & clear breakpoint.
- ★ DISASSEMBLER: HEX or ASCII dump labels located by address, not just assigned - writes assembler format file to memory location.

THE PACKAGE IS COMPLETE AND READY TO LOAD USING YOUR EXISTING DOS INPUT/OUTPUT ROUTINES.

**DISKETTE + EXTENSIVE MANUAL ONLY \$48.00** 

1st Class Postage, Insurance, Handling & Calif. Residents - 6% Sales Tax Included.

11:30 - 9:00 10 - 6

VISA"



14300 BEACH BOULEVARD • WESTMINSTER, CA 92683

**CIRCLE INQUIRY NO. 68** 

# BYTE SHOP

OF OHIO

OHIO'S FIRST

**MICROCOMPUTERS PERIPHERALS ACCESSORIES** 

IMSAI 8080 BYTE-8 SWTP MP68 CROMEMCO TECH PROCESSOR

MEMORY EXPANSION LEAR SIEGLER ADM 3

INTERFACES (KITS or ASSEMBLED UNITS)





#### PROGRAMS AND SOFTWARE

VARIOUS BASICS - TINY, 4K, 8K and 12K FOCAL - DOS - GAMES - BUSINESS APPLICATIONS

ALSO AVAILABLE ... APPLE 1 CASSETTES FL OPPIES

MODEMS TERMINALS DEC. WRITERS

BUSINESS APPLICATION INQUIRES INVITED
SYSTEM DEMONSTRATIONS AND LITERATURE / MAGAZINES.

19524 CENTER RIDGE ROAD **ROCKY RIVER, OHIO 44116** (216) 333-3261

> HOURS: TUES. thru FRIDAY 12 to 9 SATURDAY

But just as important, the Pennywhistle 103 is backed up by a complete documentation manual. This manual describes what a modem is and how it works. It also contains a thorough set of assembly, test and adjustment instruc-tions as well as directions for hooking the modem up for direct wire connection, modemto-modem communication, tape recorder connection and long distance use. With a tape recorder, this modem may be used to record data from a remote source over the phone line and enter the data into the memory of a com-

The Pennywhistle 103, available from M&R Enterprises, P.O. Box 61011, Sunnyvale, CA

**CIRCLE INQUIRY NO. 126** 

#### Digital-to-Analog Converter for KIM-1

The Micro Technology Unlimited DAC board is a complete audio output system for the KIM-1 or any other microcomputer system. Included along with the 8 bit digital to analog converter is a sharp cutoff low-pass filter and low power high-fidelity amplifier capable of driving any 8 or 16 ohm speaker. With nothing more than the basic KIM-1 and the MTU DAC board, music with true 4-part harmony and organ-quality tones can be generated.

Connection is via PORT A on the KIM-1. Power requirements are +5 volts and +12 volts at such a low current drain that any power supply meeting the worst-case power requirements of the KIM can successfully power the DAC board also.

Included with the DAC board is a complete schematic and a cassette tape containing a 4-part harmony music program that plays the Star Spangled Banner and Exodus in a voice that sounds much like a Hammond organ. The tape is a standard KIM format cassette.

An inexpensive yet high quality 7 inch speaker (less enclosure) is available as an accessory

An Extended Music Software Package will be available later this year. It will be supplied on a KIM standard cassette and will include additional songs, a music language compiler/ editor, and a Fourier Series Program for creating new voices from harmonic specifications.

#### Specifications:

DAC Board:

Price \$35.00

Power: +5V @ 2MA, +12V @ 10MA quiescent 150MA peak with 16 ohm load.

- 2. DAC Section: 8 bits guaranteed monotonic, straight binary input code, 0 to +5 volts output, 5K source impedance. +5 power input is heavily filtered and used for the reference source.
- 3. Low Pass Filter Section: 6 poles, 1 dB Chebyshev response, 3.0kHz cutoff.
- 4. Power Amplifier Section: 20 Hz to 20 kHz response ± 3 dB, load impedance 8 ohms or more, maximum output 100 MW @ 8 ohms, 200 MW @ 16 ohms.

Price \$ 5.00

- 1. 7 inches diameter, full range cone.
- 2. 5 ounce ceramic ring magnet.
- 3. 16 ohm impedance matches power amp on DAC board.

**Extended Music** 

Software Package:

Will run on basic KIM-1 with cassette tape.

Will utilize additional memory for longer songs and separate waveforms for each voice, if present.

NOTE: The Speaker and Extended Music Software Package are available only to purchasers of the DAC board.

For further information contact, The Computerist, P.O. Box 3, S. Chelmsford, MA 01824, (617) 256-3649.

**CIRCLE INQUIRY NO. 127** 

# BOOK REVIEWS

#### MICROPROCESSOR BASICS

Edited by Michael S. Elphick. Selected from ELECTRONIC DESIGN. Hayden Book Co., Inc., 1977.

224 pages, paperback, \$9.95.

Review by Judy Scolney Robertson and Larry Robertson

Microprocessor Basics is a collection of articles from Electronic Design magazine. Most of the articles are directed towards design engineers using microprocessors in special purpose applications. The book contains three general sections: "Getting Started with Microprocessors," "Some Alternatives to Microprocessors," and "Testing and Debugging Microprocessor Systems"; five sections on specific equipment: the 8080, the 6800, the F8, PACE, and the IMP chip system; and a final section, "Some Recent Microprocessors," which discusses the 2650, the Cosmas 1802, and the use of the 6100 in CMOS systems.

Elphick has done an admirable job of collecting, organizing, and introducing the material in this book. He has included excellent descriptions of hardware with a strong emphasis on cost and instruction times. He has also assembled a variety of information on alternate hardware sources. Microprocessor Basics does include considerable discussion of software, but these articles take an engineering viewpoint, emphasizing the most efficient way of using the processor and ignoring the fact that the best programming methods may emphasize maintainability, standardization, and freedom from errors as more important than absolute processor efficiency. In addition, the software articles tend to ignore the fact that the microprocessor is much faster than most peripheral devices attached to it, making super-efficient programs somewhat less important than one is led to believe.

In his introduction, Elphick admonishes the reader to be aware of

all the systems discussed in this book, and not to concentrate just on his favorite device. On this point, we could hardly agree more heartily.

The articles are all excellent and provide a fair amount of data for effectively comparing the usefulness of several microprocessors in various applications. *Microprocessor Basics* is a valuable piece of literature for anyone concerned with microprocessor system design, and a handy reference for the home computer hobbyist.

# BIPOLAR MICROCOMPUTER COMPONENTS DATA BOOK FOR DESIGN ENGINEERS

The Engineering Staff of Texas Instruments, Incorporated, Semiconductor Group. Texas Instruments, Inc., 1977. 270 pages, paperback, \$2.95

Review by Judy Scolney Robertson and Larry Robertson

Texas Instrument's Bipolar Microcomputer Components Data Book for Design Engineers is almost three hundred pages of detailed specifications for Texas Instrument, Inc.'s most recent selection of offerings to the rapidly expanding microprocessor market. The most interesting item discussed is the SB 9900 microprocessor, a 16-bit word length computer compatible with the 900 and 990 families. The 9900 has a full minicomputer instruction set, including multiplication and division. Review of the specification sheets for the 9900 reveals a very powerful microprocessor. Software packages are available on cassette for this system, and include monitor. assembler, loader, editor and trace routine.

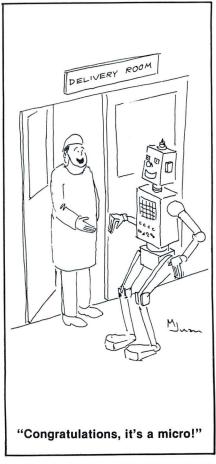
Texas Instruments' new bipolar components are described in great detail. Particular attention might be directed to the specifications for microprogrammable 4-bit slice processor elements for controllers and

other applications. Both Integrated Injection (I²L) and Schottky TTL elements are discussed, including the I²L 16-bit microprocessor mentioned above. Also included is an extensive list of new memories of all types: PROMs, ROMs, RAMs, and asynchronous FIFO components.

Microcomputer support functions, including bus transceivers, line drivers, shift registers, field programmable logic, flip-flops and latches are described in extensive detail. Certainly not to be ignored are the specification sheets for the controller and driver for the 8080A system.

This book is aimed at the design engineer. If you are interested in Texas Instruments' latest offerings in the microprocessor field, by all means buy it. If not, skip it.

Bipolar Microcomputer Components Data Book for Design Engineers is available directly from Texas Instruments Incorporated, P.O. Box 5012, M/S 54 (Attn: Bipolar Data Book), Dallas, Texas 75222.

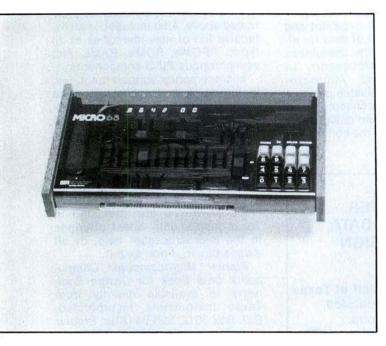


**INTERFACE AGE 121** 

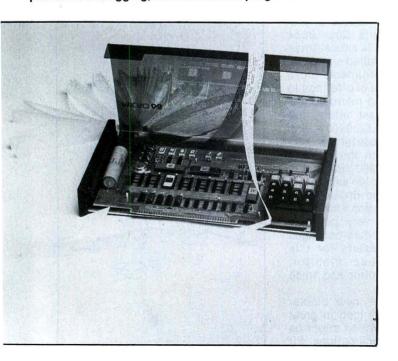
# CARD OF

# THE EPA

by Roger H. Edelson,



Available in a hardwood cabinet with an optional attache case, the MICRO-68 comes complete with self-contained power supply, hexadecimal keyboard, and six-digit LED display. A 512-word PROM holds all the routines needed to load, inspect, and edit object programs, insert breakpoints for debugging, and execute the program.



This month, rather than a single card, we will cover a one-card computer - the EPA (Electronic Product Associates, Inc.) MICRO-68 computer. The MICRO-68, as sent to me, is a complete portable desk-top computer packed in an optional Samsonite carrying case the size of a normal briefcase. All that was necessary to use the computer was to open the case, insert the A.C. plug into the wall socket, press two of the keyboard buttons, and go. My two 14-year-old sons, and my 11-year-old daughter were writing programs on the MICRO-68 within minutes after I had opened the carton. A friend of mine used the computer for one week to learn the basics of computer programming, and indeed, everyone who saw it operated it quickly, easily, and liked it.

As delivered, the MICRO-68 consists of one large printed circuit card mounted in a hardwood and plastic cabinet, as shown in Figure 1. The computer contains a hexadecimal keyboard, and six 7-segment LED displays. The MICRO-68 is a Motorola 6800-based machine, and includes a 512-word PROM, a 128-word RAM, two PIA's, and the A.C. supply. The PROM contains the keyboard monitor routine, and the RAM memory may be expanded on board to 768 words in 128 word increments. The memory map of the MICRO-68 is shown in Figure 2. The keyboard control PROM is located at FE00 to FFFF. The keyboard control program uses 0068 to 007F for temporary storage, and 0061 to 0067 is used to store the MPU registers. 005B to 0060 is used for the stack address save. The user has access to memory from 0000 to 005A in the basic one-board MICRO-68, while additional memory may be located from 0080 to FDFF. A TTY/ RS232 CRT/Audio Cassette adapter (the TCC3) may be piggy-backed onto the main board. With this adapter in place Tiny BASIC may be loaded (provided by EPA for my evaluation), and simple BASIC programs may be run.

EPA provides an expansion cabinet for the addition of increased memory and general purpose boards. This cabinet also contains an additional 3.5 amp. power supply for powering the added boards. Available memories include both an 8K and a 4K board, a 16K PROM memory system, a 2K PROM expansion board, and both PROM and RAM chips. Other accessories include terminals, printers, and floppy disc systems. Software includes a Tiny BASIC, monitor routines, MIK-BUG, and a MOTOROLA resident assembler/editor. In all, the EPA makes up a relatively nice package for the low to medium end of the home computer spectrum. As it is not an S-100 bus system, none of these accessories will fit, but the presence of a compatible floppy-disc does increase the scope of the MICRO-68.

Let's take a look at the basic MICRO-68 computer as I received it. Figure 3 provides a layout diagram of the printed circuit board and Figure 4 is the circuit diagram of the MICRO-68. As can be seen, the computer is based on the 6800 CPU chip supported by 6810 RAMs, 6820 PIAs, and Harris H-PROMs. Bus drivers for the expansion connector are not provided, but there is provision on the PC board for installing them later. The power supply is not shown on the schematic, but consists of a

# THE MONTH

# MICRO-68

#### Hardware Editor

wall-plug transformer, (8.5V. @ 1.5 A.), 4-1N4001 rectifiers, a .01 fd. capacitor, and an LM309K 5V regulator; not particularly sophisticated, but more than adequate.

The U26 PIA provides an access to the system from the edge connector P2. This edge connector and the expansion edge connector are not gold-plated, which could possibly lead to reliability problems after use. The lines are not buffered. (See Figure 5). This PIA also services the keyboard. The other PIA is reserved for the six LED displays.

The computer clock is provided from a 9602 monostable, and VMA (Valid Memory Access) is combined with the  $0_2$  clock to get both  $\overline{VMA} \cdot 0_2$  and  $\overline{VMA} \cdot 0_2$  as required by the RAMs, PROMs, and PIAs.

To get the MICRO-68 up and running (after plugging into the wall) all that is necessary is to depress the "0" and "4" keys simultaneously. These signals are "anded" together by U14 and U21 to provide a RESET signal for the MPU. This results in initializing the keyboard control program and provides a display of "EPA-UP" on the LED displays. The MICRO-68 will now respond to the keyboard commands.

Figure 6 shows the hexadecimal keyboard and indicates the keys which double as command keys when the computer is in the EXPECT COMMAND mode. The following lists indicate the type and scope of the available keyboard commands.

| FFFF<br>FE00 | KEYBOARD CONTROL<br>PROM LOCATIONS                               |
|--------------|--|
| FDFF         |  |
|              | USER'S<br>MEMORY EXPANDABLE TO 64K<br>OF RAM + ROM + PROM        |
| 0800         |  |
| 007F         |  |
|              | KEYBOARD CONTROL PROGRAM USES<br>THIS AREA FOR TEMPORARY STORAGE |
| 0068         |  |
| 0067         |  |
|              | MPU REGISTERS GET STORED HERE<br>WHEN AN INTERRUPT OCCURS        |
| 0061         |  |
| 0060<br>005B | STACK AREA FOR MONITOR SUBROUTINE<br>ADDRESS SAVE                |
| 005A         | USER'S AREA  |
| 0000         |  |

RAM — RANDOM ACCESS MEMORY

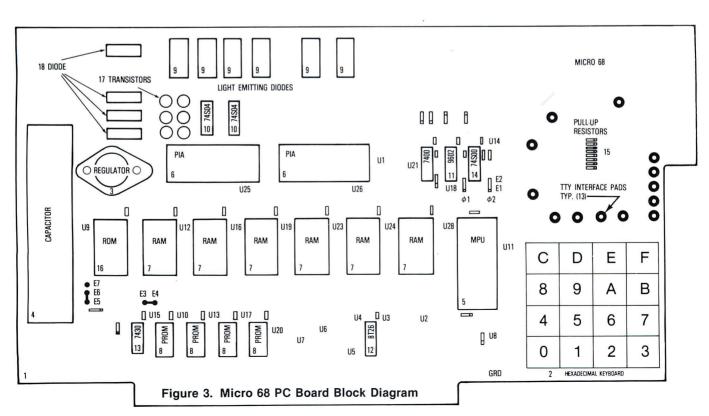
ROM - READ ONLY MEMORY

ADDRESS

PROM — PROGRAMMABLE ROM

MPU - MICROPROCESSOR UNIT

Figure 2. Memory Map



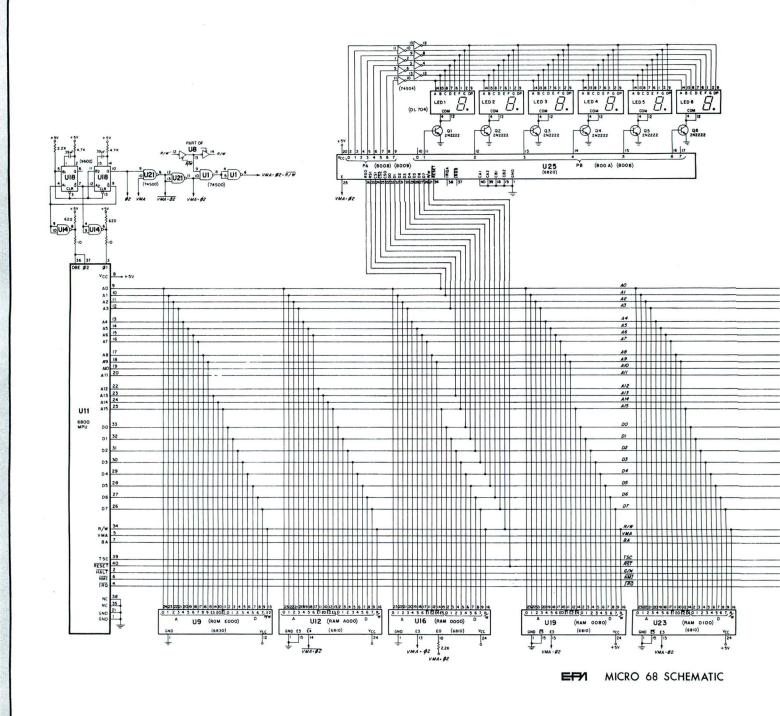
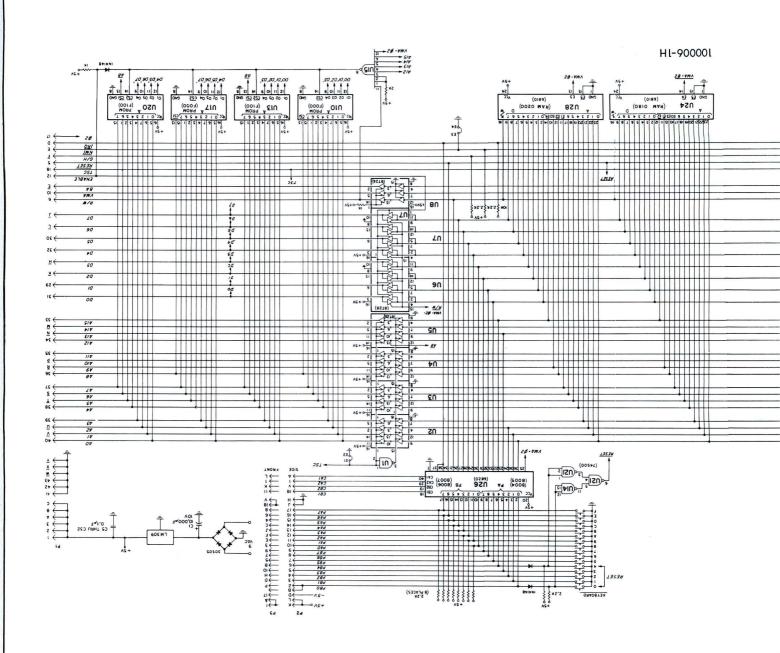
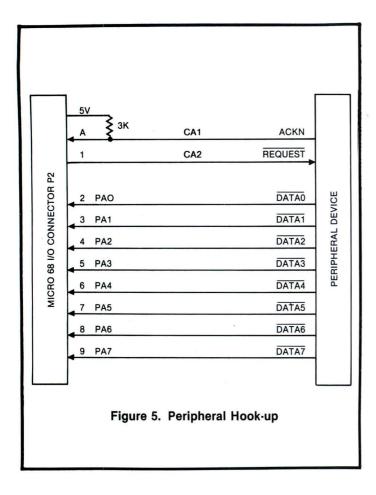


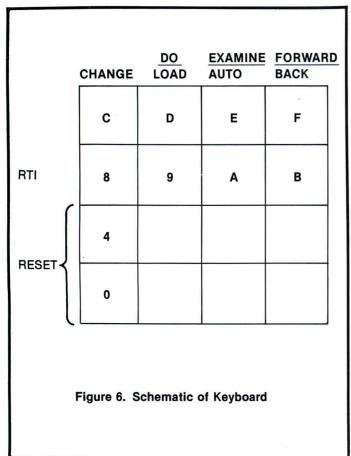
Figure 4. EPA MICRO 68 Schematic 100006-1H.

124 INTERFACE AGE AUGUST 1977

7761 TSUĐUA







THE EXAMINE COMMAND: The "E" key doubles as EX-AMINE. This command lets you enter a personally selected address (memory location) of four digits.

Enter EXAMINE (E) \_\_ \_ \_ Displayed

Enter 0003 00\* Displayed

\*00 is used as an example

THE FORWARD COMMAND: The "F" key doubles as FORWARD. This command lets you increment the displayed address by one digit. Repeating the command lets you step forward through memory and examine the contents of each succeeding address.

Enter FORWARD (F) 0004 FF\* Displayed
Enter FORWARD 0005 04\* Displayed
Enter FORWARD 0006 A8\* Displayed
and so on
\*These are examples only

THE BACK COMMAND: The "B" key doubles as BACK. This command lets you decrement the displayed address by one digit. Repeating the command lets you step back through memory and examine the contents of each preceding address.

Enter BACK (B) 0005 04\* Displayed Enter BACK 0004 FF\* Displayed and so on

THE CHANGE COMMAND: The "C" key doubles as CHANGE. This command lets you modify the contents of the memory location.

If no memory exists at the selected location, the contents digits will display undefined data and no modifications can be made. The appearance of two dashes (——), after ENTERING two contents digits, indicates that you are trying to modify the contents of a non-existent memory location.

Enter CHANGE (C) 0004 -- Displayed Enter 86 0004 86 Displayed

THE AUTO COMMAND: The "A" key doubles as AUTO. This command causes the contents to be cleared and the address to be automatically incremented.

| Enter AUTO (A)    | Displayed      |
|-------------------|----------------|
| Enter <u>0004</u> | 0004 Displayed |
| Enter <u>86</u> * | 0005 Displayed |
| Enter <u>00</u>   | 0006 Displayed |
| Enter <u>14</u>   | 0007 Displayed |
|                   | and so on      |

\*When the 2nd digit key is depressed, content is registered and displayed. When the key is released, the address is automatically incremented and the content is cleared and ready for new content insertion. Automatic command is exited by pressing RESET.

THE DO COMMAND: The "D" key doubles as DO. This command lets you enter the starting address of a program, and immediately enables MICRO 68 to execute the program.

Enter DO (D) - - - - do Displayed

Enter 0007 At this point, the MICRO 68 will start executing instructions beginning at 0007.

THE RETURN FROM INTERRUPT COMMAND: The "8" key doubles as RETURN FROM INTERRUPT (RTI). This command lets you handle interrupts from the keyboard. Pushing the RTI key causes a return from interrupt instruction to be executed in the keyboard control program.

THE LOAD MEMORY COMMAND: The "9" key doubles as

# We do more than just sell computers

We give you more than just the run-of-the-mill computer store. Whether browsing or buying, you'll find a professional atmosphere that is also relaxed and casual. Plus an array of incomparable benefits. Such as an extensive selection of microcomputers. A full range of peripherals. Broad microcomputer experience. Full technical support. Software and books. Even leasing. We're dedicated to giving you more at The Computer Mart.

**Extensive Hardware Selection** Whatever your microcomputer needs, we have the hardware for you. Imsai, Processor Technology, Polymorphic, Cromenco, Apple and more.

**Full Range Of Peripherals** We have virtually any type of peripheral you'll need to complete your system. Sanyo monitors. Northstar and iCom floppy disk systems. Lear Siegler terminals. Additional memory. Tape Cassettes. Paper tape readers. Plus, much more.

**Microcomputer Experience** We have solid microcomputer experience gained through selling hundreds of microcomputers. We know what you can expect from your system. That's important to you.

**Technical Support** We stand behind the products we sell. With an experienced five-person service department. When you have a problem, we're there with the solution.

**Library Of Software And Books** We have a substantial library of software. And, are committed to developing new software programs to expand the uses for your microcomputer. Plus, we have an extensive library of instruction books, programming aids and periodicals. Come in and browse anytime.

**Classes On Microcomputers** If you're just getting started in microcomputers, we have a series of classes designed to acquaint you with the operations of a microcomputer and its BASIC programming language.

At the Computer Mart, we do more than just sell computers.

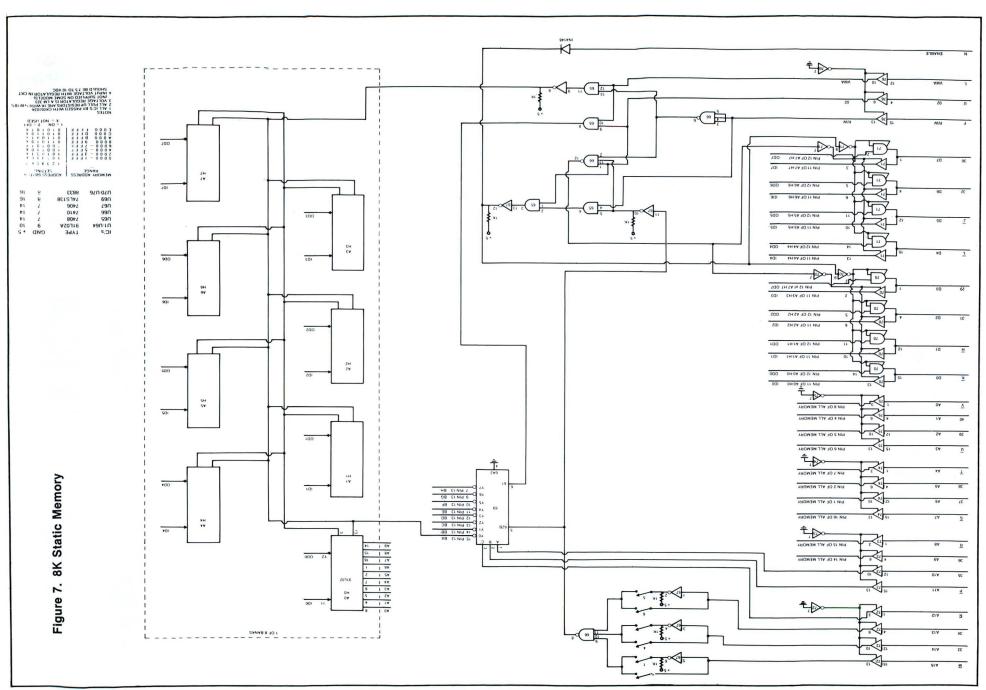
**Phone Orders** are processed promptly. Send for a free catalog today.

**Hours** Tuesday-Friday 10:00-8:00 Saturday 10:00-5:30 Sunday 12:00-5:00

# THE COMPUTER MART

633 West Katella Avenue, Orange, California 92667, (714) 633-1222 BankAmericard and Mastercharge Accepted, Leasing Available.

AUGUST 1977 CIRCLE INQUIRY NO. 74 INTERFACE AGE 127



LOAD MEMORY (LOAD). This command lets you load the RANDOM ACCESS MEMORY (RAM) automatically from an external device such as a paper tape reader or mark-sense card reader. Figure 5 shows the I/O signals used for this feature.

Upon execution of the program, the STACK POINTER is left pointing at location 0067. Assuming that your program does not modify the value of the STACK POINTER. an interrupt will have the following effect:

The STATUS of the Microprocessor Unit (MPU) will be saved in locations 0067 through 0061. The STACK POINTER will be left pointing at location 0060 and control passes to the keyboard control program. You can then examine and change the saved status of the MPU. To return to the interrupted program, enter the RTI command. This causes the MPU to be reloaded with the current values in the SAVE STACK. Execution then resumes.

If the program happens to modify the value of the STACK POINTER, an interrupt will have the same effect as just explained, except the SAVE STACK will be located wherever the STACK POINTER was left pointing. After the status of the MPU has been saved, the value of the STACK POINTER is stored in locations 0068 and 0069. It can be determined exactly where the SAVE STACK is by examining locations 0068 and 0069 after an interrupt. The RTI command causes the MPU to be reloaded from the SAVE STACK wherever it was located after the interrupt occurred.

| RAM LOCATION | CONTENTS AT LOCATION               |
|--------------|------------------------------------|
| 0061         | Condition Codes Register           |
| 0062         | B Accumulator                      |
| 0063         | A Accumulator                      |
| 0064         | Index Register, High Order 8 bits  |
| 0065         | Index Register, Low Order 8 bits   |
| 0066         | Program Counter, High Order 8 bits |
| 0067         | Program Counter, Low Order 8 bits  |
| 0068         | Stack Pointer, High Order 8 bits   |
| 0069         | Stack Pointer, Low Order 8 bits    |

Except for the RESET interrupt, you can specify the interrupt destination. The destination after the RESET interrupt is always the keyboard control program. By default, the destination after the INTERRUPT REQUEST (IRQ), NON MASKABLE INTERRUPT (NMI), and the SOFTWARE INTERRUPT (SWI) is also the keyboard control program. The destinations of these three interrupts can be specified by the user by changing the following **RAM locations:** 

| LOCATION               | SPECIFICATION                     |
|------------------------|-----------------------------------|
| 006A-High Order 8 bits | IRQ Destination Address (16 bits) |
| 006B-Low Order 8 bits  |                                   |
| 006C-High Order 8 bits | SWI Destination Address (16 bits) |
| 006D-Low Order 8 bits  |                                   |
| 006E—High Order 8 bits | NMI Destination Address (16 bits) |
| 006F-Low Order 8 bits  |                                   |

Figure 7 shows the diagram of the 8K static memory expansion board. 8833 chips are used for the memory. The expansion memory was not supplied with my MICRO-68, so I can't tell how it works. The TTY adapter was provided and after connection Tiny BASIC was loaded and run for small programs. The system works very well and is a most easily used educational system. My kids thoroughly enjoyed the device even though they have occassional access to an S-100 Bus system. The MICRO-68 is particularly good for teaching machine language programming as the hexadecimal keyboard and the AUTO make it easy to load and run.



# COMPUTER MART

Now Accepting Orders for INTAC (INTEL assembled and tested components)

# MEMORY BOARDS!

ALTAIR/IMSAI S-100 Bus compatible. Guaranteed for 1 year and includes 9 bits (1 parity bit) and an extra chip. Deliveries in late August or early September. 16K - \$485.00. 32K - \$845.00.

Last year we opened the first computer store on the East Coast. This year we moved out of the Hobby Store and into our new Real Systems Showroom and Store. The largest display of up-and-running computer equipment. The same friendly help and advice. Plus - all the bits and pieces you can't find elsewhere! Plain and Fancy Software, too! IMSAI, PRO-CESSOR TECHNOLOGY, SOUTH WEST TECHNICAL PRODUCTS, DIGITAL CESSOR TECHNOLOGY, SOUTH WEST TECHNICAL PRODUCTS, DIGITAL GROUP, OSI, VECTOR GRAPHICS, ALPHA MICRO TECHNOLOGY, CROMEMCO, COMPUCOLOR, POLYMORPHIC SYSTEMS, SOROC TERMINALS, SEALS, TARBELL, MORROW, TDL, NORTH STAR, QUAY, APPLE, OLIVER, SMOKE SIGNAL, MULLEN, GBC MONITORS, O.K. MACH. CONT. SPEC. VECTOR, E&L INST. and - COMPUTER MART PRODUCTS. More coming!!

-Stan Veit, Storekeeper

# COMPUTER MART OF NEW YORK INC.

118 Madison Ave. (Enter on 30th St.), New York, NY 10016 (212) 686-7923

**CIRCLE INQUIRY NO. 75** 

# FRFF

SYSTEM SELECTION ADVICE. WE WILL HELP YOU TO CHOOSE FROM THE BEST OF EACH MANUFACTURER TO COMPLETE THE SYSTEM BEST SUITED TO YOUR NEEDS, COME SEE AND TRY:

PROCESSOR TECH. SOL-20 SYSTEM TDL ZPU Z16K CROMEMCO POLYMORPHIC VECTOR GRAPHICS IMSAI BYTE

ICOM DISCS NORTH STAR TARBELL SEALS DYNABYTE LEAR ADM-3A COMPUCOLOR SOROC SANYO HITACHI

ALPHA MICRO 16 B OKIDATA DECWRITER MULTITERM S.R.POLYPHONIC COMPUTALKER S.S.MUSIC I.C.'S. SOCKETS TOOLS, SUPPLIES BOOKS, MAGAZINES

### LAWNDALE

# the affordable computer store

16508 HAWTHORNE BLVD.

LAWNDALE, CA 90260 (213) 371-2421

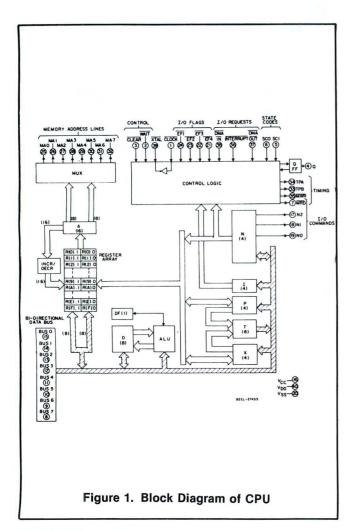
HATTAN BEACH BLVD ARTESIA RIVO

TORRANCE

HRS: TUE.-FRI. 12-8, SAT. 10-6 BANKAMERICARD . MASTERCHARGE . AMERICAN EXPRESS

# THE COSMAC

The COSMAC is gaining fans in the hobby market. Here the author describes its salient features. Read on and evaluate them for yourself.



# by Brian Kapitan

The COSMAC microprocessor is an 8-bit registeroriented central-processing unit designed for general purpose computing or for use as part of a control system. It features:

- Static silicon-gate CMOS circuitry
- Instruction fetch-execute time of 2.5 to 3.75 microseconds at 10V
- · Single voltage supply
- No minimum clock frequency
- Low power
- TTL compatible
- Any combination of RAM and ROM
- Memory addressing up to 64 K bytes
- Programmed I/O mode
- On-chip DMA
- Four I/O flag inputs directly tested by branch instructions
- Programmable output port
- 91 instructions

## REGISTERS

This microprocessor features sixteen 16-bit registers. Individual registers are selected by a 4-bit binary code from one of the three 4-bit registers (N, P and X). The contents of the registers can be directed:

- 1) to external memory
- 2) to the D register (either high or low bytes)
- 3) to the increment/decrement circuit

COSMAC instructions usually consist of two 8-clock pulse machine cycles. The first is the fetch cycle and the second is an execute cycle. During a fetch, the 4-bits in the P designator select one of the 16 registers as the program counter. When the instruction is read out of memory, the high order bits are loaded into the I register and the lower 4 bits into the N register. Then, the program counter is incremented by one, causing R(P) to be pointing to the next byte in memory.

The X designator selects one of the 16 registers to find in that register an operand or section of data to be

used in an ALU or input-output operation.

The N designator can perform many different operations. One of these is to designate one of the 16 registers to be acted upon during a register operation. It may also designate a command-code or device-selection code for peripherals. It is also used to indicate a specific operation. Another, and the most used of this register, is to load a value into the P or into the X designator.

# PROGRAM COUNTERS

The purpose of the P designator is to indicate the program counter. The 4-bit binary code of the register whose purpose is to be the program counter is held in the P register. Other register can be loaded with a specific address in a program, and then the P designator can be changed to that register there by causing a call to a subroutine. When interrupts are being used, the R1 register is the program counter.

# **DATA POINTERS**

The R registers may also be used as data pointers. That is that they may point to a location in memory. The

# **MICROPROCESSOR**

X designator points to a register for an ALU operation, for input and output instructions and for other control and miscellaneous operations. The N register is also used as a data pointer. It is used in many memory loading operations into the D register.

The last use of the R register as a data pointer is in the DMA function. Register R0 is always used as the data pointer for memory in a DMA operation. Data is written in or read out using the register as the pointer. The best thing about the DMA-input is that the user can load programs into memory directly without the need of a bootstrap loader.

# **DATA REGISTERS**

Another purpose of the R register is the storing of data. These data may be read into the D register. Since the D register is only eight bits and the R registers are 16 bits, only parts of the R registers can be loaded into the D register. The R register is divided into two parts: high and low bits. The high order bits of any register is R.1 and the low order is R.0. Also, the register may be used as loop counters through the use of the increment and/or decrement operations.

| Register | Number of<br>bits maximum | Purpose                          |
|----------|---------------------------|----------------------------------|
| D        | 8                         | data register—accumulator        |
| DF       | 1                         | flag for ALU carry/borrow        |
| R        | 16                        | scratchpad registers             |
| P        | 4                         | designates program counter       |
| X        | 4                         | designates data pointer          |
| N        | 4                         | holds low order instruction bit  |
| Î        | 4                         | holds high order instruction bit |
| T        | 8                         | holds old X,P after interrupt    |
| IE       | 1                         | interrupt enable                 |
| Q        | 1                         | output flip-flop                 |

# THE Q FLIP-FLOP

The Q flip-flop is an internal flip-flop that can be set or reset and can be sensed in a branch instruction and can also be used for output.

# MICROPROCESSOR INSTRUCTIONS

M(R(X)) + D : DF,D

means that the memory byte pointed to by R(X) is added to D and the result is placed in D. If the total of the two is greater than FF (hex 255) then DF (data flag) is set for 1. Otherwise it is kept at zero.

| OP | MNEMONIC | OPERATION  |
|----|----------|--|
| 00 | IDL      | idle; wait for DMA or interrupt, M(R(O)): BUS            |
| C4 | NOP      | no operation; continue                                   |
| DN | SEP      | set P; let P equal N                                     |
| EN | SEX      | set X; let X equal N                                     |
| 7B | SEQ      | 1:Q  |
| 7A | REQ      | 0:Q  |
| 78 | SAV      | save temporary storage T: M(R(X))                        |
| 79 | MARK     | push X,P to stack (X,P) : T ,(X,P) : M(R(2)), P:X R(2)-1 |
| 70 | RET      | return M(R(X)): (X,P), R(X)+1, 1:IE                      |
| 71 | DIS      | disable interrupt same as above but: 0:IE                |
| ON | LDN      | load via N M(R(N)):D N cannot equal 0                    |
| 4N | LDA      | load and advance M(R(N)):D R(N) + 1                      |
| F0 | LDX      | load via X M(R(X)):D                                     |
|    |          |  |

| 72<br>F8<br>5N<br>73                   | LDXA<br>LDI<br>STR<br>STXD  | load via X and advance M(R(X)):D R(X) + 1<br>load immediate M(R(P)):D R(P) + 1<br>store via N D:M(R(N))<br>store via X and decrement D:M(R(X)) R(X)-1  |
|--|-----------------------------|--|
| 1N<br>2N<br>60<br>8N<br>AN<br>9N<br>BN | INC DEC IRX GLO PLO GHI PHI | increment register R(N)+1 decrement register R(N)-1 increment register R(X)+1 move low N register to D R(N).0:D reverse of above D:R(N).0 move high N register to D R(N).1:D reverse of above D:R(N).1   |
| F1<br>F9<br>F3<br>FB<br>F2<br>FA<br>F6 | OR ORI XOR XRI AND ANI SHR  | $\begin{split} &M(R(X)) \text{ or } D\text{:}D\\ &\text{ or immediate } M(R(P)) \text{ or } D\text{:}D  R(P)+1\\ &\text{ exclusive or } M(R(X)) \text{ xor } D\text{:}D\\ &\text{ exclusive or immediate } M(R(P)) \text{ xor } D\text{:}D  R(P)+1\\ &M(R(X)) \text{ and } D\text{:}D\\ &\text{ and immediate } M(R(P)) \text{ and } D\text{:}D  R(P)+1\\ &\text{ shift right } D \text{ ; least significant bit } D\text{:}DF   \text{msb set} \end{split}$ |
| 76                                     | SHRC<br>RSHR                | to zero<br>shift right D; Isb(D):DF; DF:msb(D)   |
| FE<br>7E                               | SHLC<br>RSHL                | shift left D msb(D):DF lsb D set to zero shift left D msb(D):DF DF:lsb(D)  |
| F4<br>FC<br>74<br>7C                   | ADD<br>ADI<br>ADC<br>ADCI   | add; $M(R(X)) + D:DF,D$<br>add immediate; $M(R(P)) + D:DF,D$ $R(P) + 1$<br>add with carry; $M(R(X)) + D + DF:DF,D$<br>add with carry, immediate; $M(R(P)) + D + DF:DF,D$<br>R(P) + 1   |
| F5<br>FD<br>75<br>7D                   | SD<br>SDI<br>SDB<br>SDBI    | subtract D; M(R(X))-D:DF,D<br>subtract immediate; M(R(P))-D:DF,D R(P) + 1<br>subtract with borrow; M(R(X))-D-(not DF):DF,D<br>subtract with borrow, immediate M(R(P))-D-(not   |
| F7<br>FF                               | SM<br>SMI                   | DF):DF,D R(P) + 1 subtract memory; D-M(R(X)):DF,D subtract memory, immediate; D-M(R(P)):DF,D R(P) + 1  |
| 77                                     | SMB                         | subtract memory with borrow; D-M(R(X))-(not DF):DF,D   |
| 7F                                     | SMBI                        | subtract memory with borrow, immediate $D-M(R(P))-(not\ DF):DF,D\ R(P)+1$  |
|  |                             |  |

|    |     | attitude from the first that the fir |
|----|-----|--|
| 3A | BNZ | branch on no zero $M(R(P)):R(P).0$ else $R(P)+1$   |
| 33 | BDF | if DF = 1 $M(R(P)):R(P).0$ else $R(P) + 1$   |
|    | BPZ | if positive or zero (same as above)  |
|    | BGE | if greater or equal (same as above)  |
| 3B | BNF | if $DF = 0$ $M(R(P)):R(P).0$ else $R(P) + 1$   |
|    | ВМ  | if minus (same as above)   |
|    | BL  | if less than (same as above)   |
| 31 | BQ  | if $Q = 1$ M(R(P)):R(P).0 else R(P) + 1  |
| 39 | BNQ | if $Q = 0$ M(R(P)):R(P).0 else R(P) + 1  |
| 34 | B1  | if $EF1 = 1$ do process $M(R(P)):R(P).0$ else $R(P) + 1$   |
| 3C | BN1 | if EF1 = 0 do above process  |
| 35 | B2  | if EF2 = 1 do above process  |
| 3D | BN2 | if EF2 = 0 do above process  |
| 36 | B3  | if EF3 = 1 do above process  |
| 3E | BN3 | if EF3 = 0 do above process  |
| 37 | B4  | if EF4 = 1 do above process  |
|    |     | INTERFACE AGE 1  |
|    |     |  |

short branch M(R(P)):R(P).0

short branch if D = zero M(R(P)):R(P).0 else R(P) + 1

no short branch R(P) + 1

38 NBR

32 BZ

INTERFACE AGE 131

Note: the following are along branch instructions. See notes below for explanation.

| CO | LBR  | long branch $M(R(P)):R(P).1, M(R(P) + 1):R(P).0$                   |
|----|------|--|
| C8 | NLBR | no long branch R(P) + 2  |
| C2 | LBZ  | branch if $D = 0$ M(R(P)):R(P).1, M(R(P) + 1):R(P).0 else R(P) + 2 |
| CA | LBNZ | branch if D not zero (process same as above)                       |
| C3 | LBDF | branch if DF = 1 (process same as above)                           |
| CB | LBNF | branch if $DF = 0$ (process same as above)                         |
| C1 | LBQ  | branch if $Q = 1$ (process same as above)                          |
| C9 | LBNQ | branch if $Q = 0$ (process same as above)                          |
| 38 | SKP  | short skip R(P) + 1  |
| C8 | LSKP | long skip $R(P) + 2$   |
| CE | LSZ  | long skip if $D = 0$ R(P) + 2 else continue                        |
| C6 | LSNZ | long skip if D not zero R(P) + 2 else continue                     |
| CF | LSDF | long skip if $DF = 1$ R(P) + 2 else continue                       |
| C7 | LSNF | long skip if $DF = 0$ R(P) + 2 else continue                       |
| CD | LSQ  | long skip if $Q = 1$ R(P) + 2 else continue                        |
| C5 | LSNQ | long skip if $Q = 0$ R(P) + 2 else continue                        |
| CC | LSIE | long skip if $IE = 1$ R(P) + 2 else continue                       |
|    |      |  |

### INPUT-OUTPUT

| 6N                           | OUT | where $N = 1$ to 7 | M(R(X)):BUS $R(X) + 1$ |  |  |  |  |  |  |
|------------------------------|-----|--------------------|------------------------|--|--|--|--|--|--|
| 6N                           | IN  | where $N = 9$ to F | BUS:M(R(X)), BUS:D     |  |  |  |  |  |  |
| NOTES ON THE INSTRUCTION SET |     |                    |                        |  |  |  |  |  |  |

- 1. the N in the op code stands for the digit in the N register.
- 2. the : in the operation means moved to.
- 3. in the input and output, the N is for the device address line.
- the branch instructions are not for subroutines. They are goto's. the short branch is used to branch to another memory location in the same page (256-byte) of memory. The long branch involves three
- bytes. The first is the instruction. The second and third are the branching address. In a short branch, there is only two bytes—one for the instruction itself, and the other for the current page branch-
- The skip instructions are used to 'skip' the next or next two instructions. Take for example instruction CE. This will skip the next two

# BITS N minnamin and BYTES SPECIALTIES: **Business Packages** Industrial Systems Entrepreneur Systems Hardware Designs Service We Stock Most Major Micro Manufacturers \*\*\* Hobbyists Welcome \*\*\* Our Representative In San Diego! Jim Farthing (714) 421-1041 BITS N BYTES College Business Park 679 "D" S. State College Blvd. Fullerton, Calif. 92631 (714) 879-8386 HOURS: 12-7 P.M. M-F

**CIRCLE INQUIRY NO. 62** 

- instructions if D = zero. If D is some other number than zero, it will continue.
- 7. In the instruction set, you may have noticed one op code with more than one mnemonic. The reason for this is it depends which instruction is before it. The same action will occur, but it is worded different to make its action clear.

### SIGNALS IN THE 1802

| BUS 0 to BUS 7 | 8-bit directional DATA BUS lines. These lines are |
|----------------|---|
|                | used for transfer of data between the micropro-   |

cessor, the memory and the I/O devices.

N0 to N2 Issued by an I/O instruction for the I/O control logic of data transfer. These lines can be used to issue commands or device selection codes to the I/O devices. The N bits are low except when an I/O

instruction is being executed. During this time, their state equals that of their corresponding bits in the N register. The direction of data flow is defined by the N3 bit, and indicated by the level of

the MRD signal.

These are flag lines that can be tested in the pro-FF1 to FF4 gram. These flag lines can have a variety of uses such as input and output for sensing of a certain

condition or counting a certain number of objects. Interrupt: X,P stored in T. X is set to 2 and

INTERRUPT DMA-IN/OUT P is set for 1 and IE is set to zero.

Dma in/out: R(0) points to memory location for input or output of memory. After input or output of data, the R(0) is incremented.

SC0, SC1 These lines indicate the action of the CPU.

process SC1 SC<sub>0</sub> fetch low low execute low high DMA high low interrupt high high

TPA.TPB Timing pulses that occur once each machine cycle MA0-MA7 these are the 8 memory address lines. The high bits appear on the line and are put into the external address latches by TPA. Then, the low order bits are placed on the lines after the TPA is com-

pleted.

**MWR** This is the memory write pulse that appears after

the address lines have been stabilized.

MRD This is the memory read level. It can be used to control 3-state outputs from the addressed

memory which may have a common data input output bus.

Q This is a single bit output line from the CPU which

can be set or reset under program control. CLOCK This is the input line for externally generated

single-phase clock. The clock is counted down at

the rate of 8 pulses/machine cycle.

XTAL purpose is to provide for external crystal for timing.

WAIT CLEAR Provide control modes as follows:

CLEAR WAIT MODE low load low high reset high low pause high high run

Load: holds the CPU in idle and allows for an I/O device to load the memory without the need of a

bootstrap loader

Reset: I,N,Q are reset, IE set, and zeros are placed

on the data bus.

Pause: stops the internal CPU timing generator on the first negative high to low transition of the in-

put clock.

Run: starts a fetch from 0000 in memory.

# OTHER COMMANDS

!Maaaa xx change memory at aaaa to xx ?Maaaa hhhh list memory at aaaa for hhhh bytes

\$Paaaa begin program execution at aaaa with p = zero

# MONITOR BOARD COMMANDS

!Rn hhhh set Rn to hhhh !Xn set X to n !Pn set P to n !Dhh set D to hh

set D flag to b = 0 or 1 !BPaaaa set a breakpoint at agaa !BR remove the breakpoint display the registers

?X dis X dis P ?P ?D dis D ?F

\$P resume program execution \$Nhhhh execute the next hhhh instructions aaaa = address xx is a hex digit pair n is a reg number

h is a hex digit

12-5 P.M. Sat.

# YSTEM SPEC

ADDITIONS TO OUR GIANT SYSTEMS BUILDERS'CATALOG Hardcopy Terminal, Papertape I/O, SWTPC 6800 KIT



Here's one of our favorite combinations of microcomputer kits and our own low cost Olivetti (90-day used gear warranteed) teletypewriters. The Olivetti 318 has all the features of a standard Teletype ASR 33, but we find it a lot easier to use than a teletype. In addition it has a 10-key numeric pad for fast input of numerics. Operating in low light levels is o.k. because the Olivetti has a small flourescent light in the platen area. The machine is much quieter. Tape reader/punch operates at 10 char/sec, RS232, includes manual, parts available from Olivetti. In this package we are also including a Potter line filter for the SwTPC 6800 to insure years of trouble free operation.

\$1216 complete, Olivetti alone \$875, Potter line Filter \$25, Shipping additional

CRT, Digital Tape Drive I/O, 16K IMSAI KIT



This is a top notch system and the Techtran Digital Cassette tape drive (90-day used gear warranteed) really establishes the system for solid heavy use. The useu gear warranteed) really establishes the system for solid heavy use. The drive features ASCII RS232 interface, off-line on-line operation, 110 to 300 baud, automatic BOT/EOT operation, 70,000 character capacity, runs directly from terminal. Combined with the 16K Imsai is our popular Hazeltine 1000, 12 x 80 CRT display (90-day used gear warranteed), 64 character ASCII, 32 ASCII control codes: 110, 300 baud. With the Imsai are 20 Viking sockets for the motherboard, serial I/O, 16K RAM and cable A.

\$2493 complete, Hazeltine 1000 alone \$695, Techtran Digital Tape alone \$595 lpha shipping

THERMAL PRINTER

Compact table top unit ideal match in size to our Monitor

Terminal Prices Cut Hazeltine 1000 now \$695

Built ADM-3 New now \$895

This NCR Thermal Printer is parallel but most models also have a Datapoint serial interface board too. 80 col, 96 char. Up to 30 cps \$375 shipping.

WRITTEN UP IN MAJOR MAGAZINES



# Green Phosphor

\*Ideal for SwTPC 64 or 1024 CRT terminal kit \*Add for a remote dis-

play to your present terminal 16mHz band width, 12" CRT, up to 20x80 display, 1v peak to peak video input, solid state, 90day used gear warranty

**\$150** & \$25 Shipping

COMPUTER **WAREHOUSE**.

AND UNITS UP to 20% OFF (Just a sample from our line) see our catalog

| Z | SCAMP | KIT    | COM  | PUTE | R   | KIT. |      | \$99   |
|---|-------|--------|------|------|-----|------|------|--------|
|   | _     |        |      | BOAR |     |      |      |        |
| 4 | SWTPC | 6800   |      |      |     |      |      | 395    |
|   | CT 64 | TERM   | INAL | KIT  |     |      |      | .325   |
|   | AC30  | AUDIO  | INT  | ERFC | E.  |      | .79  | 9.50   |
|   | GT61. |        |      |      |     |      |      | .99    |
|   | PP40  | PRINT  | R    |      |     |      |      | .250   |
|   | SMOKE | SIGN   | AL B | ROAD | CA  | STIN | IG16 | K \$59 |
| ( | INTER | CEPT . | JR.  | 12K  | RAI | ٧    |      | 145    |
| ( | KIM-1 | 6502   |      |      |     |      |      | 245    |

| ●IMSAI 8080A KIT 22 SLOT\$751 |
|-------------------------------|
| 4K MEMORY KIT                 |
| SERIAL I/O KIT125             |
| 65K RAM CARD3899              |
| 32K RAM BOARDKIT 749          |
| ASSEMBLED 1099                |
| 16K RAM BOARDKIT 499          |
| ASSEMBLED 679                 |
| PROM 4-512 KIT165             |
| VIKING 100 PIN CONNECTORS,    |
| HEAVY DUTY \$3 00             |

SIGN UP FOR OUR

1st ONE IS ALL GONE

SECOND GIANT CATALOG

Mailing Date October 1 -- Over 80 pages -- \$1. Books / Kits / and Fabulous Used Gear Bargains

Company Street

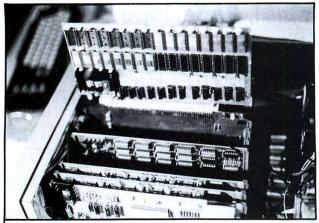
☐ Check enclosed ☐ Cash enclosed

A SUBSIDIARY OF AMERICAN USED COMPUTER CORPORATION \* 548 COMMONWEALTH AVE. BOSTON, MA 02215 617-261-2700

☆ "See us in Atlantic City, Boston and New York" ☆

# **SOME REMARKS**

# **PHOTO 1**



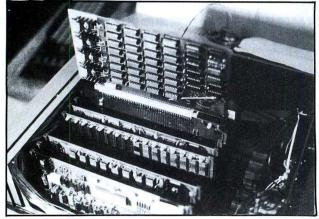
Typical 16K Static Memory board, but with memory chips for only the second and fourth 4K block of memory. This is shown operating on top of a Mullen extender board.

# **PHOTO 2**



S.D. Sales' 4K Static Memory board in pieces, three bags of parts and the Printed Circuit board. Text and schematics are not shown, but were included. Assembly is easy.

# РНОТО 3



Assembled S.D. Sales board, being tested. Refer to text for comments on the jumper wire (lower right-hand corner).

# by Gordon Berry

I got into the home computer hobby at a relatively early stage through the purchase of one of MITS' \$995 8K BASIC specials. Soon I learned that home computing develops a voracious appetite for memory; when the BASIC interpreter occupies 6K of memory or more, there isn't much space left for the BASIC programs. I did quite a bit of pondering on memories and the results were a comparison in the Kansas City Computer Network's *Thruput* magazine (Sept. 1976). At that time, I could find only 11 companies advertising memory boards for the Altair bus; but even then, that's a fair amount of competition. now, you have an even wider choice.

Probably like many other of the early "computer nuts," once my computer was operating, I started going through Ahl's 101 BASIC Games, entering first the shorter programs, and noting how they worked. Soon I found that additional memory would be a necessity. The evaluation mentioned above led me to decide to buy a 16K static memory board, but the wisdom of consumer credit limits constrained me to equip the 16K board with only 4K chips. Later I purchased another eight chips to give me 8K on one board, and most recently I purchased a 4K board to bring my total possible consecutive memory to 20K.

First, I shall discuss why this memory is handy, then I'll discuss some of the technical details of the various memory boards, but only on a general level, not the E.E. degree level.

My computer system is still spare in terms of peripherals. I have an SWTPC TV Typewriter, interfaced to the computer through a parallel (MITS 4PIO) interface port; MITS ACT (audio cassette recorder I/O); and aside from the memory, that's about it. I'll add a "bit boffer" to the ACR board, for the K.C. Standard frequencies, and hope soon to add a printer.

If you go anywhere beyond one manufacturer's standard configuration of input-output devices, you find some amount of machine language programming modification necessary. That modification may require extra memory, as my parallel I/O to the TV Typewriter does. With the programmable I/O characteristics of the Motorola 6820 PIA integrated circuit used on the MITS 4PIO board, comes the requirement for machine language programming to set the IC up for whatever are its requirements. In addition, I couldn't get the "handshaking" signals between the computer output and the TVT input to operate correctly (the computer sends a single saying "here's data; catch it"; the terminal was expected to throw up a signal saying "don't send more data, I haven't digested your first data yet." However, the terminal was so slow that the computer had shot out half a line of data before the terminal began recognizing the first data byte. I never did figure out if this was a design problem or a construction problem for which I was responsible. I resolved this by writing a short machine language delay loop. The total I/O software totaled only fifty or so instructions: not much, but it just happens that Lynn Cochran's "Star Trek" (written in BASIC) would not quite fit into a 12 K configuration, with the chunk taken out by the I/O drivers. So, step by step, more memory was added.

# **ON MEMORIES**

Another problem cropped up. I had received from Processor Technology their Software No. 1 Assembler, Editor, and Monitor package: beautiful software, but only one problem. It's written to operate in high memory. What does this mean? You know the 8080 CPU chip can address 64K of memory, if you could afford it. You can envision that as 16, 4K chunks. The way this software package works, is that it requires the last, highest 4K chunk for its own code. It requires a 4K chunk somewhat below that for some of the code it builds; and finally, it requires a chunk somewhere else, into which to stick the actual text of the material you are writing. Since it is an assembler, you need memory somewhere for it into which to assemble your text. If you only have 12K, two chunks are taken for the software package, leaving only 4K for text files. I know I'm rather wasteful of memory space, but assembly language text eats up memory space very rapidly. I've been trying recently to revise a monitor that will occupy about 1K memory ROM, in assembly language. the text (line number, spaces, instruction mnemonic, comments) takes up 14 to 15K of memory. Since I don't have that much memory, I'm writing it in segments. You can then see the 20K memory not only gives memory space, it gives location flexibility.

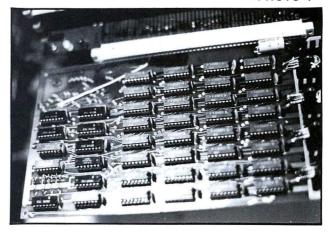
Now then, on to the memories themselves. There are two types of memory ICs used: static and dynamic. Dynamic memories, in turn, may be mounted on boards which give visible refresh or "transparent" refresh. Refresh simply means that circuitry is required to run through some or all of a given IC's addresses within a given time. On early MITS 4K dynamic boards, the refreshing circuitry was visible, that is, it got in the way of the CPU, and had to tell the CPU to go into a "wait" state until the refresh circuitry could get out of the way. Most current dynamic memory boards are "synchronous"; they may be termed "transparent refresh." The circuitry that runs through all of the IC's addresses does so during times that the CPU could not anyway get to memory.

With static memory, on the other hand, you have none of this garbage of refreshing. As long as power is on, assuming it is working normally, the memory will hold its data. Most common of this type is variations upon a theme of 2102. The 2102 and its variations are 1K by 1-bit, meaning a 4K memory board has 32 of them; the only widely available(?) 4K static IC is the EMM Semi 4200. If you see an ad for a 16K static board, it probably uses this chip. No second source is available, as far as I know, through the NEC  $\mu$ PD410 (at twice the price) is close, with a slightly different pinout. The Mostek MK4200 is a Dynamic 4K memory, not at all compatible with the EMM 4200.

The real point of these comments, however, is to get specific about the experience I've had with the varieties of memory boards I've built. Initially, the MITS 4K dynamic boards came with the computer. These were put together carefully, and have since worked without a hitch. MIT no longer sells these. They replaced them with a board with synchronous refresh. You still might be able to pick up one or two of these boards used —

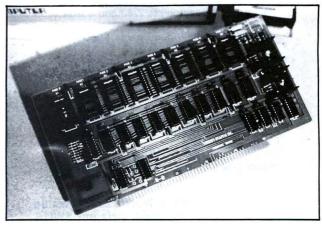
Power consumption had been a problem with the early micros, but these boards require no power supply mods, voltage boosters or bridge rectifiers.

**PHOTO 4** 



One method of allowing easy re-addressing of a board not equipped with a dip-switch for this purpose. Obviously, this section of the board has to be handled with care.

**PHOTO 5** 



The Reset-and-Go PROM-RAM board from Vector Graphic. A beautifully laid out, screened and masked board for up to 2K of 1702 (256-by-8 bit) EPROMs. As soon as I get my monitor in the shape I want it in . . .

just be sure you're not getting somebody else's lemon. But if somebody is short of space in his computer, and is going to 16K boards, you *might* get a bargain. They would be more difficult to trouble-shoot than static boards, so you should not pay the cost of a new static board for a 4K dynamic board.

The nice feature of having RAM on the same board with ROM, is that the ROM can be programmed to use a stack in RAM space devoted to it, and no requirement is imposed on other memory boards in terms of their addresses. Thus, I could put all my boards in high or low memory space and the monitor will still function. In fact, it would function without any other memory board in the computer; a characteristic that might be useful in troubleshooting a system, for example.

The Vector Graphic board only holds 2K ROM, 1702-type. Really bigger programs would require some other ROM board that could hold more ROM memory.

A final note on the whole memory question: the question of power consumed as memory is added usually comes up. Apparently this can be a problem in the early Altairs, but the boards described above operate in mine with no trouble. I have seen power supply mods, such as the Parasitic Engineering's one, or one fellow's solution (putting a transformer in series with the main one to boost the voltage out of the power supply) or another's (installing a really big bridge rectifier), but I won't believe this is a problem until I see it, then I'll consider how I'll solve it.

Table 1 lists memory boards available for the S-100 or Altair bus, as best I can glean from current advertisements. You should, if you contemplate purchase, make your own inquiries. And my apologies in advance if I've missed anybody, or misrepresented any manufacturer's products.

# Bits and Bytes COMPUTER SHOP

IN

# **PHOENIX**

AFFORDABLE — OFF THE SHELF

# **KITS**

- Z-80 Boards for Vector/Altair/IMSAI
- Vector-1 microcomputers Z-80 and 8080A
- Tarbell Cassette Boards
- Solid State Music Video Boards & 8K RAM
- Vector Graphics 8K RAM
- EPROM Boards and EPROM Burners
- 16 K RAM for S-100 Buss Vector/Altair /IMSAI

## **ASSEMBLED**

- · ACT-1 Terminals and 9 or 12 in. Monitors
- EPA 6800 System with I/O to CRT/Casette/TTY And full line of boards and peripherals

### SPECIALS

☆ Vector Z-80 17K RAM & EPROM Software \$999

Books Magazines Bits and Bytes Pickles & Trout

6819 North 21st Avenue Phoenix, Arizona 85015 (602) 242-2507

**CIRCLE INQUIRY NO. 63** 

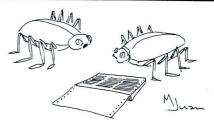
I ordered a MIKRA-D 16K board with 4K chips. It was constructed easily, but at first gave considerable trouble. It was sent back to MIKRA-D, and I believe they declared it repaired by replacing several of the memory IC's. I later replaced another of the initial IC's. I was apprehensive about risking more money, but still I purchased eight more of the EMM4200's. They plugged in and have worked beautifully ever since. This last memory board has one problem and several inconveniences. Its problem is that the protect circuitry not only protects, it flips the "protect" switch and writes garbage into the memory. The problem is not solved, but avoided by simply never protecting that board.

The inconveniences are in the addressing of the board. A jumper wire places the whole 16K board space at one of four locations: 0-16K, 16-32K, and so on. For me to move individual pieces of the board, I must physically remove the memory ICs on the board in some cases. Obviously, if I had the full 16K chips, this wouldn't be a problem.

The price on the S.D. Sales 4K board proved irresistible. I conveniently overlooked the fact that, with shipping and with the extra 100-pin socket for the computer's motherboard, this came very close to the price of another set of ICs for the 16K board. I experienced no problems with memory protect circuitry on the S.D.S. board, because it hasn't any. I haven't missed it. Soldering and construction of the S.D.S. board was easy; but before soldering, I should have simply checked the edge connector for shorts between adjacent traces. The solder mask on the top side of the board concealed an area where the data in traces are very close, and on this particular board, the solder mask concealed a short between two traces. It also prevented easily cutting between the traces, so I simply severed the shorted trace, and soldered a jumper wire across the shorted area. This jumper wire may be seen at the lower righthand corner of the board in the picture.

In the upper right-hand corner of the board are pads for jumpers for setting the board address. Since a handy little dip-switch would not fit them, I simply bent short pieces of lead wire into little hooks, which can be easily desoldered and moved for readdressing the board without abusing the printed circuit traces. One has to be careful, however, that the leads sticking up don't short against other leads.

Finally, what must rank as the best-quality board-kit of the lot is remarkable in other ways. It differs from the above boards in being partially ROM, partially RAM. It is the Vector Graphic's "Reset-and-Go" board. You may notice the photos don't show any ROMs on the board. I ordered it without their pre-programmed monitor ROM. Because of the unique set of instructions I need to talk to the TV Typewriter. Vector Graphic's ROMs also assume a Tarbell cassette I/O, and I wanted some different routines in my monitor, so I'll do my own monitor. The board, however, is well laid out, and includes 2102-type RAM. Construction took only an hour or so. Instructions were clear, and nicely printed. Obviously they care about their product.



"As they say in computerese — when your program doesn't run, de-man it."

|   |                             |  | ×   |              |                          |                    |   |
|---|-----------------------------|--|---|--------------|--------------------------|--------------------|---|
| MANUFACTURER  | STORAGE                     | PRICE  | BUFFERED                                    | PROTECT      | EDGE                     | POWER              | COMMENTS  |
| Associated Electronics<br>12444 Lambert Circle<br>Garden Grove, CA 92641  | 16K                         | \$349 Kit<br>549 Assm.                           | Yes   | ?            | ?                        | ?                  | Dynamic Memory,<br>"Transparent Refresh"  |
| Advanced Microcomputer Prod.<br>P.O. Box 17329<br>Irvine, CA 95208        | 8K                          | \$248 Kit  | Yes   | ?            | ?                        | ?                  | Static Memory "Low power 21L02s, 450 ns, switch sel. Addressing, Battery Back-up" |
| Duotronics<br>P.O. Box 9160 expand t<br>Stockton, CA 95208                | 4K<br>o 8K                  | \$159 Kit<br>285 Kit                             |   | No           | ?                        | .9A-1.5A           | Static Memory   |
| Dynabyte—RHS Marketing<br>2233 El Camino Real<br>Palo Alto, CA 94306      | 16K                         | \$485 Assm.                                      | Yes   |              |                          |                    | Socketed; Dynamic, "Transparent refresh" "Tested, burned in"                      |
| Electronic Control Technology<br>P.O. Box 6<br>Union, N.J. 07083          | 8K<br>16K                   | \$295 Kit  | Yes   | ?            | ?                        |                    | "Exceptionally Low Power,"<br>Static Memory                                       |
| Franklin Electric Co.<br>733 Lakefield Road<br>Westlake Village, CA 91361 | 8K                          | \$239 Kit<br>295 Assm.<br>225 and                | Yes<br>280 without sod                      | Yes          | ?                        |                    | Static Memory<br>Switch select address<br>Battery Back-up                         |
| Godbout Electronics<br>P.O. Box 2355<br>Oakland Airport, CA 94614         | 4K                          | \$ 99.95 Kit                                     | Yes   | No           | No                       | .75A               |   |
| Cromemco Inc.<br>2432 Charleston Road<br>Mountain View, CA 94043          | 4K<br>16K                   | \$195 Kit<br>295 Assm.<br>\$495 Kit<br>795 Assm. | Yes   | ?            | ?                        | ?                  | Static Memory uses "Address<br>Anticipation." All have "bank<br>select" feature   |
| IMSAI Corp.<br>14860 Wicks Blvd.<br>San Leandro, CA 94577                 |                             | \$449 Kit<br>lynamic memor<br>mory" systema      | Yes<br>ry system to 65K.<br>also available. | Yes          | ?                        | ?                  | Dynamic Memory, "Hidden refresh," "Low power"                                     |
| MITS  | 4K                          | \$167 Kit  | Yes   | Yes          | Yes                      | ?                  | Static Memory   |
| 2450 Alamo S.E.<br>Albuquerque, NM 87109                                  | 16K<br>4K                   | 765 Kit<br>195 Kit                               | Yes<br>Yes                                  | ?<br>Yes     | Yes<br>Yes               | ?                  | Static Memory Dynamic Memory  |
| PolyMorphic<br>737 S. Kellogg<br>Goleta, CA 93017                         | 8K                          | \$300 Kit  | Yes   | ?            | ?                        | ?                  | Dip Switch Address select,<br>Battery back-up                                     |
| Processor Technology  | 4K                          | \$159 Kit  | Yes   | ?            | No                       | "low"              | Static Memory   |
| 6200-S Hollis<br>Emeryville, CA 94608                                     | 8K<br>16K                   | 295 Kit<br>529 Assm.                             | Yes<br>Yes                                  | ?            | No                       | "low"              | Static Memory<br>Dynamic Memory   |
|   | All feature bat             | tery back-up, s                                  | ockets, Dip switc                           | n addressing |                          |                    |   |
| S.D. Sales Co.<br>P.O. Box 22879<br>Dallas, TX 75228                      | 4K                          | \$ 89.95 Kit                                     | Yes   | No           | No                       | "low"              |   |
| Seals Electronics<br>P.O. Box 11651<br>Knoxville, TN 37919                | 8K<br>8K<br>(Prices might   | \$295 Kit<br>\$295 Kit<br>depend on deal         | Yes<br>er)                                  | ?            | edge<br>connec.<br>extra | "low"              | Static, 500ns chips<br>Static, 250nc chips<br>Battery back-up                     |
| Technical Design Labs<br>342 Columbus Ave.<br>Trenton, NJ 08629           | 4K<br>16K<br>Battery back-u | \$169 Kit<br>574 Kit<br>p; sockets               | Yes   | Yes          | No                       | 205ma              | Static Memory<br>Same board as 4K above, but<br>16K chips installed.              |
| Vandenburg Data Products<br>P.O. Box 2507<br>Santa Maria, CA 93454        | 16K                         | \$299 Kit  | Yes   | ?            | No                       | 475ma              | Dynamic Memory<br>Invisible refresh   |
| Vector Graphic Inc.<br>717 Lakefield Road<br>Westlake Village, CA 91361   | 8K                          | \$265 Kit<br>305 Assm.                           | Yes   | Yes          | No                       | 1.35a              | Static Memory<br>Dip switch address<br>Battery back-up                            |
| Omni Systems, Inc.<br>P.O. Box 7536<br>Provo, UT 84602                    | 16K                         | \$459 Kit  | Yes   | Yes          | No                       | Less than<br>1 Amp | Static Memory<br>200ns Access time, Battery back-up<br>Paging Option              |

Note: When "Battery Back-up" is indicated in the table above, it indicates that there is some on-board provision for connecting to a battery back-up system, but the batteries and whatever else is needed, is not a part of the memory board. With rare exceptions, sockets are provided for all integrated circuits as a part of the kit. "Paging Option" allows expansion of memory beyond 65K, though this would be moot for most hobbyists. However, a paging option board might be useful where a RAM memory board needs to coexist in the same memory addressing space as a ROM board. Here, the paging feature would be used as a board disable feature.

AUGUST 1977 INTERFACE AGE 137

# PRODUCT PREVIEW

# AN INTEGRATED DUAL MINI-FLOPPY MICROCOMPUTER SYSTEM

# by Frank Adams

The minifloppy disc is expected to have a significant impact on microcomputer systems requiring small mass storage. Prior to the minifloppy disc, users requiring small mass storage had the choice of standard floppy discs or tape drives. Standard floppies have not met price and size requirements of many applications. Tape drives are available that meet these size and price requirements but do not provide the random access capability of the disc.

Introduction of the minifloppy has enabled GNAT Computers to combine this inexpensive mass storage device and a sophisticated microcomputer system into a single package. The minifloppy was first marketed by Shugart in 1976 followed closely by Wangco with a compatible version. Several companies offer the minifloppies as peripherals to microcomputers. The GNAT-PAC

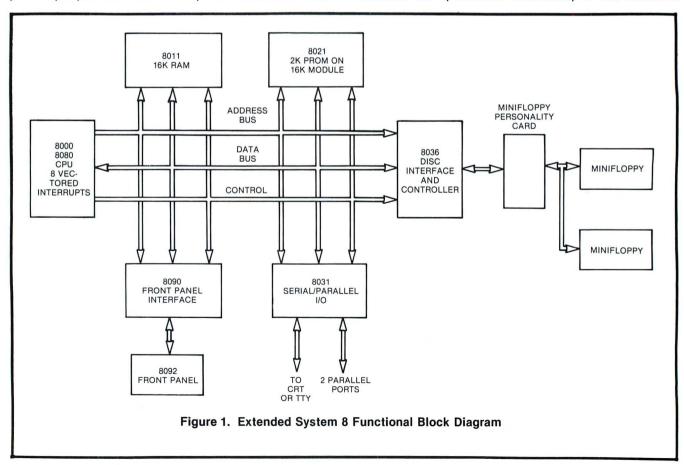
Extended System 8 is the first fully integrated minifloppy microcomputer.

The complete disc operating system provides the user with the software tools necessary to write and debug programs both in assembly language and BASIC. Typical uses for a dual minifloppy system include program development, small business systems and control applications for industrial users.

# MINIFLOPPY MICROCOMPUTER HARDWARE

This system is designed for commercial and industrial microcomputer applications. Not available in kit form, the GNAT-PAC is supplied as a completely assembled and tested system.

Six GNAT microcomputer system modules are standard in System 8. The block diagram, Figure 1, illustrates the operational relationship of the modules.





# The Byte Shop is Ready, Willing and Able to satisfy your computing needs.

# Ready

Your Byte Shop is ready to supply computer products off the shelf for the computer hobbiest, experimenter, home entertainer, or business entrepreneur. Computers in kit form or assembled and tested.

# Willing

Your Byte Shop is willing to help in the advice, education, or handholding necessary for your selection of a computer tailored for your application.

# Able

Your Byte Shop is able to provide the full service and support required for a product of sophistication.

# Why

Because Byte Shop wants to be your Computer Store.

What are you waiting for? Come on in.

## Arizona

Phoenix-East 813 N. Scottsdale Rd. Phoenix-West 12654 N. 28th Drive 2612 E. Broadway

# California

Berkeley 1514 University Ave. Burbank 1812 W. Burbank Blvd.

AUGUST 1977

Campbell 2626 Union Ave.

Diablo Valley 2989 N. Main St.

3139 E. McKinley Ave.

Hayward 1122 "B" Street

Lawndale

16508 Hawthorne Blvd.

Long Beach

5433 E. Stearns St.

Mountain View

1063 W. El Camino Real

Palo Alto

2233 El Camino Real

Pasadena

496 W. Lake Ave.

Placentia

123 E. Yorba Linda

Sacramento

6041 Greenback Lane

San Diego

8250 Vickers-II

San Fernando Valley

18424 Ventura Blvd.

San Francisco

321 Pacific Ave. Santa Barbara

4 West Mission

Stockton

7910 N. Eldorado St.

Thousand Oaks 2707 Thousand Oaks Blvd.

Ventura

2409 Main St.

Westminster

14300 Beach Blvd.

## Colorado

Arapahoe County 3464 S. Acoma St. 2040 30th St.

### Florida

Cocoa Beach 1325 N. Atlantic Ave., Suite 4

**CIRCLE INQUIRY NO. 64** 

Ft. Lauderdale 1044 E. Oakland Park Blvd. Miami 7825 Bird Road

# Minnesota

Eagan 1434 Yankee Doodle Rd.

# New York

Levittown 2721 Hempstead Turnpike

Rocky River 19524 Center Ridge Rd.

## Oregon

Beaverton 3482 SW Cedar Hills Blvd. Portland 2033 SW 4th

# Pennsylvania

Bryn Mawr 1045 W. Lancaster Ave.

# South Carolina

Columbia 2018 Green St.

### Utah

Salt Lake City 261 S. State St.

# Washington

Bellevue 14701 NE 20th Ave.

## Canada

Winnipeg 665 Century St.

# Japan

Tokyo Towa Bldg., 1-5-9 Sotokanda

the affordable computer store

INTERFACE AGE 139

# These modules are:

# 8000 CPU MODULE

8080A PROCESSOR - Best supported micro 8 Vectored fully maskable interrupts Fully buffered inputs and outputs

LS Devices for low power consumption and high reliability

8011 16/64K RAM MODULE with 16K RAM
Up to 16K of 4K dynamic RAM devices
Up to 64K of 16K dynamic RAM devices
Board address switches
Memory write protect
Memory disable for bank switching
Refresh transparent to processor

8021 16K ROM MODULE

(with 2K PROM containing GNATBUG Monitor and disc drivers)

Up to 16K of 2708 PROM or equivalent Board address select switches 8K or 16K Operation Memory Disable for bank switching

# 8031 SERIAL/PARALLEL I/O

 Serial I/O port with RS232, 20MA current loop, differential, TTL, and Data Set Signals
 Selectable Baud Rate - 75 to 9600 Baud
 Full TTL parallel I/O Ports
 Board address select switches

### 8090 FRONT PANEL

Bus plug-in for development and maintenance, easy to read hexadecimal address and data display. Complete system control features hardware breakpoint, Jam, DMA, exam, load, run, single step, reset,

# SAVE 5% To 15% On The World's Finest Hardware & Software. Call (315) 637-6208 NOW.

|                             | List Price | Our Price |
|-----------------------------|------------|-----------|
| IMSAI 808 Kit with 22 slots | \$751      | \$645     |
| IMSAI 4K 500ns RAM Kit      | \$139      | \$117     |
| North Star Micro-Disco      |            |           |
| System Kit                  | \$699      | \$599     |
| Gromemco Bytesaver Kit      | \$195      | \$185     |
| Vector Graphic 8K 500ns RAM | 1          |           |
| (Assembled)                 | \$265      | \$225     |
| Edge Connectors & Guides fo | r IMSAI    |           |
| (In lots of 10-each)        | \$ 7       | \$ 4      |
| Our own Extender Board      |            |           |
| w/connector                 | \$ 30      | \$ 15     |

Shipping charges: \$10 per CPU or larger units; \$1.50 per kit. \$2.00 minimum per order.

Provided stock is available, we will ship immediately for payment by cashier's check, money order or charge cards. Allow 3 weeks for personal checks to clear.

N.Y. State residents add appropriate sales tax. Prices may change without notice.

See us at Booth 416 in Atlantic City Categories TM

PO Box 71 • Fayetteville, New York 13066

**CIRCLE INQUIRY NO. 72** 

plus sense switches and the display is addressable from software.

# 8036 FLOPPY DISC CONTROLLER

Control up to 4 regular or 3 minifloppies On-Board Data Buffer for software flexibility Automatic Seeking Disk Initialization IBM soft sectored format

A user may select additional modules from the complete GNAT Microcomputer System to meet his exact memory and I/O requirements.

The standard power supply provides ample regulated DC for two minifloppies and 12 microcomputer modules. Power supply features include RFI line filtering, current limiting, over-voltage protection, and high temperature shutdown. It is user selectable for 110/220 VAC, 50/60 Hz.

Each minifloppy disc supplies up to 80K of formatted data, single density. The data are available from the 5-inch disc with an access time of 40msec. per track. Dual minifloppy discs are especially useful in file management, program development, and back-up storage.

# **DISC OPERATING SOFTWARE**

Complete disc operating software is necessary for utilization of the minifloppy capabilities. The GNAT System 8 uses the well-known CP/M disc operating system written by Gary Kildall of Digital Research, Monterey, California. The disc operating system, the PROM resident monitor and disc-based BASIC compiler comprise the complete software support package.

The PROM resident GNATBUG monitor contains the I/O drivers, terminal commands, RAM test, and the operating system bootstrap loader.

The CP/M disc operating system includes the editor, assembler, and dynamic debugger with trace, test, and debug. Also included are the file manager, console commands, peripheral interchange, dump, load and submit.

The BASIC E compiler has been written specifically for operation with the CP/M disc operating system. It fully utilizes the capabilities of CP/M's extensive file management system. Since BASIC E requires 20K of RAM, additional memory must be added. It can be most effectively used with an additional 16K RAM module.

# **USE OF THE DUAL MINIFLOPPY SYSTEM**

GETTING ON THE AIR is accomplished through a front panel entered bootstrap. This 3-byte sequence (C3, 00, F8) is a jump to the PROM resident monitor.

The SYSTEM MONITOR provides elementary data manipulation operations such as INSPECT, DUMP, FIND, GO TO, and MOVE. Typing E (Executive) loads the operating system from the disc into memory.

WRITING PROGRAMS is accomplished using the editor. The editor is used for writing both assembly language and BASIC programs. The editor generates source files and back-up files for the convenience of the user. The assembler operates on assembly language source files producing a hexadecimal object file and an assembled print file. Especially useful in debugging programs is the dynamic debugger. This debugger executes and traces programs under console control saving many trying hours of program debug time.

The BASIC COMPILER produces run-time object code from the BASIC source file. The run-time object code is executed simply by typing RUN File Name. With the CP/M file manager, BASIC programs can open and close files, plus read and write to the disc.

The GNAT FRONT PANEL enables the user to monitor and control program execution. Features including address and data displays, breakpoint, DMA, and JAM give hardware support to program development.

# Why The Digital Group is the computer for you:



# Software

A broader selection of software than any other manufacturer: Extended Basic, Tiny Basic, Assembler, Disassembler, Text Editor, Z80 Educator plus 65 games.

# **Price**

Absolutely the most cost effective computer on the market.

- \* Z80 CPU, video-cassette, I/O, power supply
- \* Keyboard upper and lower case
- \* Video monitor high resolution
- \* Cabinets for computer, keyboard and video monitor
- \* Nothing else needed It's complete!

# **Power**

The Digital Group offers the largest selection of CPUs: Z80, 8080A, 6502, and 6800.

# Style

Attractive yet functionally designed cabinetry reflect professionalism and distinction.

# Peripherals

Low cost, full size printer Large capacity tape drives

# Quality

Superior engineering and materials.

# Why buy from Sunshine Computer Company?

- \* The equipment is available now. In stock!
- \* Expert technical assistance.
- \* On premise repair facility.

One of The Digital Group's oldest, most experienced and largest dealers.

# Sunshine Computer Company

COME SEE OUR NEW EXPANDED OFFICES IN THE CARSON BUSINESS PARK.

20710 South Leapwood Avenue Carson, California 90749 (213) 327-2118

Punch tape still remains the hobbyist's most popular medium of storing and transferring data. In this article the author describes one feasible and inexpensive solution.

# TELETYPE PUNCH

# INTRODUCTION

One of the many problems with hobby computers today is the transfer of data between systems. There have been many standards proposed for cassettes, in fact, so many that there really is no standard. The most universal 'standard' method of interchange of data still remains the paper tape medium (with all of its drawbacks). Long articles are written telling of how paper tape wears out and dries out and is an obsolete medium for data transmission. But it is still around and going strong in today's professional computer world and as well as in the hobby sector.

Paper tape readers are becoming rather cheap, \$70. for a hand pulled reader. A company now sells a motor-driven paper tape loader that does not stop on character, rather offers the advantage of a motor that pulls the tape past the photo electric read head for only \$150. Full fledged stop-on-character readers which have a speed of 200-300 characters per second, can be purchased for \$300. With these readers, 8K of main storage can be loaded in under a minute. The only problem is that nothing is being said about or offered for sale in the area of paper tape punches. The obvious place to look for these devices is in the surplus marketplace. A new punch with reasonable performance characteristics usually starts in the \$500. range, and a 10 CPS punch is just as objectionable as a 10 CPS reader.

The most readily available punch that I have seen is a punch made by Teletype Corporation. It carries the letters BRPE and is a very impressive unit. It weighs around 25 pounds and is built to last a lifetime. They can be obtained either in a used rundown condition or newly-reconditioned. (There is an obvious expense for the reconditioning.) Mine came run down and dirty. It took a long ten hours to clean and properly oil it. There are literally dozens of oil points and felt pads that have to be oiled. Also many of the moving parts become gummy and have to be cleaned for proper operation. A punch

maintenance manual is desirable but not absolutely necessary. There are a number of critical adjustments and cleaning should proceed with care.

After the punch is cleaned the next problem is the interfacing of the punch to one's home computer, which is the subject of this article. The speed of the BRPE punch is very impressive when compared to a model 33ASR Teletype. It punches at a maximum rate of 110 characters per second, which is 9.1 milliseconds per character.

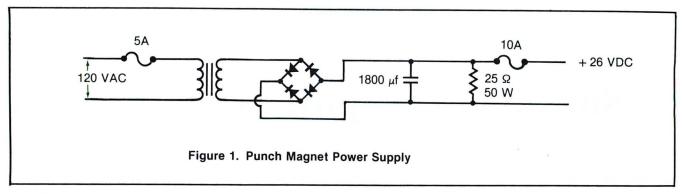
# **PUNCH POWER SUPPLY**

The first thing that is needed for an interface is a really hefty power supply to drive the punch magnets on the punch. There are nine magnets, one for each of the eight columns of the paper tape and one which causes the punch to advance one character. Only oiled paper tape should be used when punching to prevent the punch from wearing out. The BRPE punch requires a -26 volt 10A supply. I found it easier to interface to a positive supply, so I built a +26V supply. The supply need not be regulated, but must be heavily filtered. Figure 1 is a diagram of the power supply that I used for the punch interface.

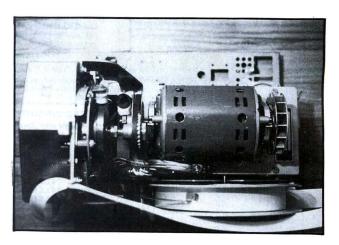
The punch is not a continuous duty device and should be powered off when no actual punching is taking place. A relay was used in the interface to allow for computer control of the power *onloff* function. Also included in the interface is a 3-second delay to allow the punch to reach operating speed before any punching is attempted.

## **CONSTRUCTION NOTES**

The interface to the computer I/O ports was built on a used printed circuit board that was mounted in the same cabinet as the CPU. Level number 3 wire wrap sockets were used to hold the IC's and the discrete components were mounted using Vector T44 pins. The layout is not



# BRPE INTERFACE



by Theodore Hillel

critical and no problems should result as long as good TTL wiring techniques are observed.

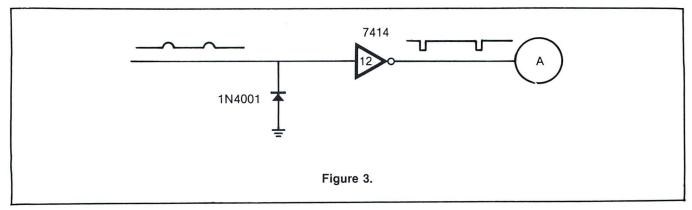
Since high current levels are being switched, these were not brought into the CPU cabinet. Instead they were isolated in a separate minibox. There are three cables running to this minibox, one from the power supply, one from the computer, and one to the BRPE punch unit. Vector board was used for the high power interface with Vector T28 clips being used to support the transistors.

# **PUNCH OPERATION**

To describe adequately the function of the interface one must understand the operation of the BRPE punch. A character first must be available for punching; the punch has a flywheel pickup to synchronize the character with the punch mechanism. A 4.5 millisecond pulse is issued to the escape magnet and to all magnets that require a hole to be punched. There is then 4.6 milliseconds lag time for the next character to be available for punching. If the character is not ready, the punch cycle is delayed until the character is available.

As was previously mentioned, the punch was initially set up to use -26 volts. On the underside of the punch are nine arc suppression diodes. These were all removed and replaced in the opposite direction to enable the punch to operate on +26 volts. This was the only modification made to the punch. All wires exit from the punch by a 24-pin Amp connector. There is also a punch paper low status which can be made available to the CPU for checking if desired. Figure 2 is a list of the 24 interface leads and their function. Note that sufficiently heavy wire should be used for the Selector magnet connections and that shielded wire should be used for the pickup coil connection. Keep all distances short (less than 6 feet) or noise problems will result.

| Figure 2. 24 Pin I | Paper Tape Punch Connector            |
|--------------------|---------------------------------------|
|                    |                                       |
|                    |                                       |
| Pin                | Function                              |
| 1                  | coil B2                               |
| 2<br>3<br>4<br>5   | coil B3                               |
| 3                  | coil B4                               |
| 4                  | coil B5                               |
| 5                  | coil B6                               |
| 6<br>7             | coil B7                               |
| 7                  | coil B8                               |
| 8                  | coil B1                               |
| 9                  | coil punch tape advance               |
| 10                 | NC                                    |
| 11                 | chassis ground                        |
| 12<br>13           | pickup coil                           |
| 13                 | NC<br>NC                              |
| 15                 | NC<br>NC                              |
| 16                 | NC<br>NC                              |
| 17                 | NC<br>NC                              |
| 18                 | coil common return (ground)           |
| 19                 | NC                                    |
| 20                 | paper out (closed if no paper)        |
| 21                 | paper out common return (ground)      |
| 22                 | paper out (closed if paper available) |
| 23                 | NC                                    |
| 24                 | pickup coil                           |
|                    | 197                                   |



NC - no connection

2102 LOW POWER 500NS RAM'S Avg OK MACHINE AND TOOL CO. PRODUCTS t draw 30 MA (INTEL spec. low at max 33 MA) RAMS made by ek . . . . . . . . . 1.45 each 1.35 each in 100 quan. current draw 30 MA power at max 33 Synertek . . . . . . BW-630 Battery Wire Wrap Gun. . 34.95 (20% discount on other 'OK' products when purchased) 2111A-4 (8111A-4) 256x4 BIT RAM made WSU-30 Hand Wire Wrap Tool . . . 5.95 931 Village Green D-2033 (313) 682-3869 Pontiac, Michigan 48054 50 ft. Kynar Wire . . . . . . . . 1.60 Hours: 12 noon - 8 p.m. (Eastern Time) INTEL S-100 64K MEMORY CARD has parity; memory sizes available 16K, 32K, 48K, 64K; S-100 buss; invisible refresh; no wait states DMA capability; memory upgradable "See us at Atlantic City" in size; fully assembled and tested. Write for details. INTEGRATED CIRCUITS MICRO PROCESSORS MICROPROCESSOR KITS INTEGRATED CIRCUITS STANDARD POWER Buy Low Power and Save Buy and Save MOTOR-2.20 Z-80 CPU 24.00 2.20 Z-80 PARRALLEL I/O15.00 1.20 8080A/9080A CPU 17.50 6.00 8251 SERIAL I/O 10.00 OLA 6800 D-2 Kit 235.00 74LS160 2.20 Z-80 74LS161 2.20 Z-80 See: July issue of Interface Age 74LS00 for Standard 7400 Series Prices. 74LS161 74LS157 MOS TECH KIM-1 74LS04 8251 8255 LOW PROFILE DIP SOCKETS 74LS181 6.00 **SDK-80** 255.00 SYS 80/10 SBC 80/10 PARALLEL I/O 11.00 1500.00 74LS190 74LS10 .38 3.20 1-99 .20 .22 .35 100-Up 2.40 8212 2.40 8214 6.00 INTEL 10.00 Board SBC 80/20 600.00 INTERRUPT 74LS193 74LS13 1.00 16 Pin 22 Pin 24 Pin .20 8224 8238/8228 C1702A S5204 INTEL 6.00 9.50 74LS20 74LS194 2.00 CLOCK CHIP Board 1050. SBC 80/04 Board-1050.00 74LS21 74LS195 .40 1.45 .34 .30 10.00 14.00 25.00 INTEL 74LS30 74LS251 1usec EROM 28 Pin 40 Pin 8085 CPU, 256 Ram, I/O, Ser. I/O Inter-.42 74LS32 74LS253 .50 .45 1Kx8 Bit EROM INTEL PROM PROM C2708 3601 74LS40 74LS257 rupt, Buss Drive Int. Timer 19 741574 62 74LS290 1.60 SPECIALS 2.00 74LS293 5624 9.50 74LS85 1.60 (Mfg. No.) (Mfg. No.) L.C. (AMI) 74122 LM304 PROM SBC 80/05 Board-8085 CPU, 80/20 4.50 INTEL 74LS86 .69 1.40 1.40 74LS365 1.25 74LS90 74LS366 S6800 24.00 ORGAN 74195 .50 6810-1 RAM 5.00 Buss, all above fea-tures of 80/04 but 741 592 74LS367 1.25 PIA ACIA SYN. ACIA MODEM UPPER CASE 74LS368 1,25 6820 74LS93 (8300) 9601 512 word Ram, More I/O 345.00 SR. .65 6850 12.00 74LS138 74LS151 1.90 1.70 1.45 74LS393 4.00 .65 74LS670 5,00 6852 16,00 SDK-85 Evaluation Board 300.00 9602 .75 6860 12.00 INTEL 4004 74S281 74LS153 25LS175 10.00 74LS155 2.00 25LS174 2513 ALU 4 Bit CPU 7x9 CHAR 12.00 8.00 MCM6571 YA-3-1015A \$9.00 Z-80 C2708 S1701 24.00 3001 INTEL - S-100 Memory Card 16Kx8 Words 520.00 Single supply 5 volts replaces all UARTS (pin for pin) 1Kx8 Bit EROM 25.00 3002 3003 INTEL 10.00 512 Bit S.R. 8.00 1.00 32Kx8 Words 800.00 INTEL 8080A with 8085 82523 32x8 Bit pROM 48Kx8 Words 1150.00 clock, interrupt, buss 6.00 RAM 64Kx8 Words drivers, serial I/O on one chip 29.00 INTEL 256x8 Ram, WSU30M—Hobby Wire Wrap Tool Modified Wrap 8T26B 8T97/74LS367 3.25 Pre-Payment: Deduct 10% 8155 75367 ECL to TTL 1.00 Delivery: Stock to 60 Days Two 8-bit I/O, 6 bit TERMS: All parts guaranteed money back; 100% tested. Postage and handling: add 5%; minimum \$1,50. Minimum order \$5,00. Michigan residents add 4% tax. We reserve the right to substitute pin for pin replacements of higher quality or speed for price of ordered device unless noted on order. Price subject to I/O, and Interval 23.00 timer 26-28 OK Battery Wire Wrap Bit change without notice. -We Quota On High Volume Orders-

**CIRCLE INQUIRY NO. 79** 

# PICKUP COIL

The first thing that must be provided to the CPU interface is the pickup coil information. The pulse voltage that one should obtain from the pickup coil is shown in Figure 3. Since the 7414 Schmidt trigger has trip points of .9 and 1.7 volts it serves as sufficient conditioning for the magnet pulse signal. A diode negates the negative part of the pulse. The positive pulse is less than 250 microseconds in duration and thus will not cause any timing problems. It might be appropriate to insert here a comment about timing loops and the interface. No software timing loops are required by this design. This interface will work with any speed and type of memory and any speed CPU, hence will not be effected if the user does a CPU upgrade. There is of course a slight increase in cost, but the small expense is well worth it. There is also an advantage as if the timings were done in software and something went wrong, the result could easily be burned transistors.

# **DRIVER CIRCUIT INTERFACE**

Once the punch has been cleaned up, the power supply constructed or purchased, and the outboard interface constructed, the only thing that remains is the construction of the interface in the computer. The board does not 'hang on the computer I/O bus' but instead obtains its information from a separate parallel I/O board. The interface requires eleven output lines and two input lines from the CPU. This interface will work with any systems latched parallel I/O ports.

Because the feed and code pulses for the punch must be presented to the punch at a specific time to be properly processed by the punch a synchronization method must be used to insure proper punching. This is done by means of a pickup coil on the punch itself. This coil is positioned near a flywheel with a permanent magnet in it. Every rotation of the punch mechanism induces a voltage in the coil when the magnet in the flywheel passes near the coil. This pulse is generated every 9.1 milliseconds at which time the punch is properly positioned to perforate a character. Figure 4 shows the expected waveform and the Schmidt trigger connections.

This synchronization is better illustrated by a timing diagram in Figure 5. Punch busy status is 'busy' for three seconds after the power-on strobe is issued and as soon as the power-off strobe is issued. It also remains 'busy' for the period from the request to punch until the end of the 4.5 millisecond punch command. The first punch strobe request is held until the power up delay has expired. The second punch request arrives too late for the next possible punch cycle and is delayed automatically by the interface until the proper time. The third punch request that is shown in the timing diagram is satisfied on the next sync point as determined by the Schmidt trigger output. Before the punch is powered off the status should be checked for not busy to determine that the last character has been successfully punched.

# **DETAILED INTERFACE OPERATION**

Two status indicators are provided to the computer by the interface, paper out, and punch busy. Paper out is positive if the supply of punch paper tape is getting low. Punch busy is 'busy' if the punch is either powered off, in the midst of its 3-second power-on cycle, or in the middle of the punch cycle. The character that is to be punched is placed on the output port that connects to the eight AND gates that drive the selector magnet interface. Power-on should then be pulsed if the power is off. Next punch request should be pulsed which sets the punch request flip-flop. When the punch status goes from busy to ready, the character has been punched.

To describe the circuit in more detail, assume the

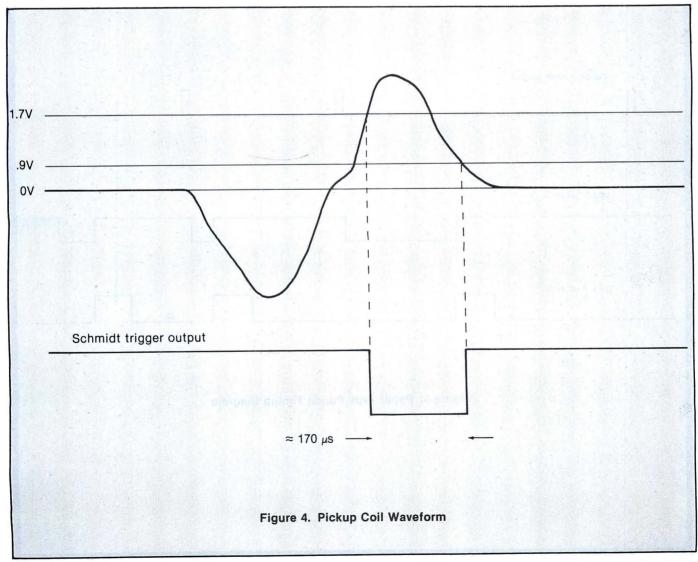
This interface is very simple to build, can be used with either -26V or +26V and requires no software timing loops.

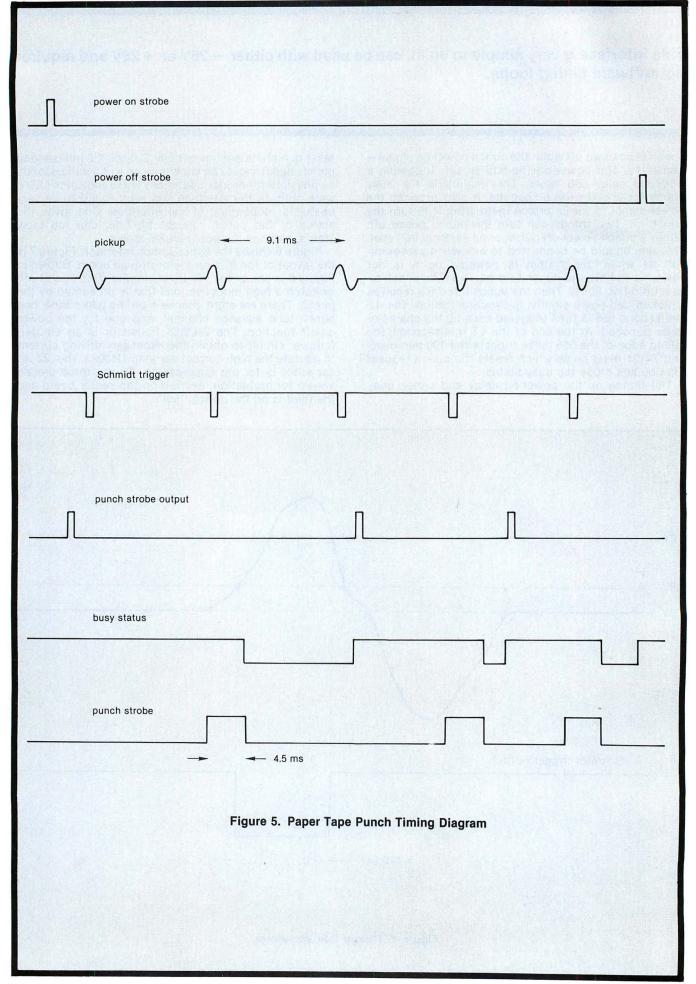
punch is powered off when the punch power-on signal is presented. The power-on flip-flop is set, triggering a 3-second delay 555 timer. This maintains the busy status for another three seconds. It also provides the power signal to the interface instructing it to turn the punch on. Two things can turn the punch power off. Either a punch power-off pulse, or an external I/O reset. This line should be connected to a power-on reset circuit as when the system is powered up it is not desirable to have the punch turn on. Next the punch request flip-flop is set. Then the punch interface receives a pickup coil pulse signifying synchronization. The 4.5 millisecond 555 is then triggered causing the character to be punched. At the end of the 4.5 milliseconds, the falling edge of the 555 pulse triggers the 100 microsecond 74121 reset pulse which resets the punch request flip-flop and drops the busy status.

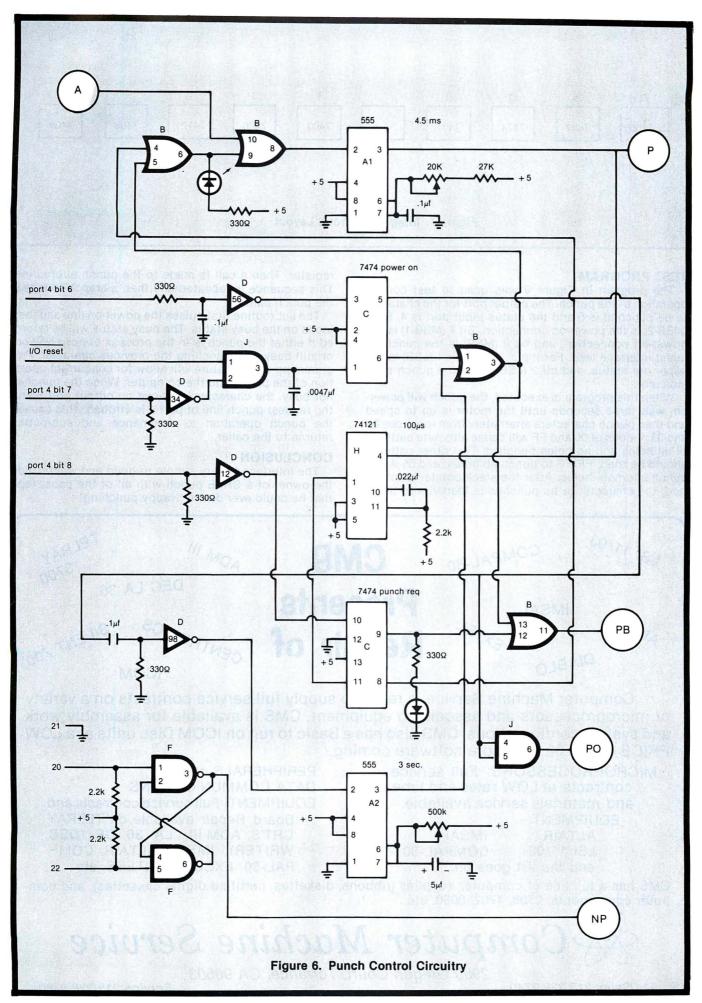
The timing on the power-on delay and punch busy

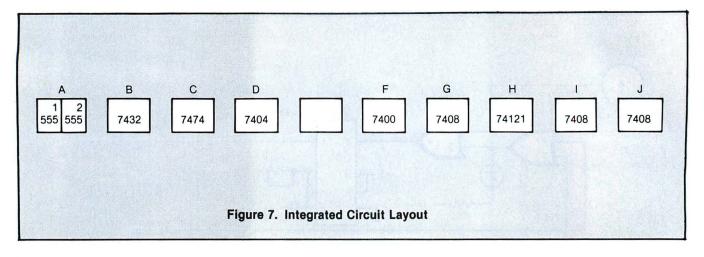
reset one shots are not critical. But the 4.5 millisecond punch signal should be kept as close to 4.5 milliseconds as possible for proper operation. Three indicator LED's were built on the interface and were found to be very useful for debugging of the interface. One gives the status of the punch request flip-flop, one the busy status, and one the punch pulse status.

Figure 6 shows the actual punch interface. Figure 7 is the layout of the IC's on the prototype board. Shown in Figure 8 is one of the I/O driver circuits. This circuit will switch the high inductive load that is presented by the punch. There are eight channels on the paper tape, one punch tape advance channel, and one for the power on/off function. The 2N3053 transistor is an emitter-follower circuit to obtain the necessary driving current to operate the high current carrying 2N3053. The .22  $\mu$ fd capacitor is for arc suppression. Of the three diodes shown for protection, two are on the vector board and the third is on the punch itself.









# **TEST PROGRAM**

The program in Figure 9 was used to test correct operation of the punch. The output port for the character to be punched is 5 and the status input port is 4. Bit 6 (MSB-2) is the power-on connection. Bit 7 (MSB-1) is the power-off connection, and bit 8 (MSB) is the punch request interface lead. For input, port 4 bit 1 (LSB) is the paper out status, and bit 2 (LSB+1) is the punch busy indicator

When this program is executed, the punch will poweron, wait three seconds until the motor is up to speed and then punch characters alternately from locations 04 and 09. Values of 00 and FF will cause alternate patterns of all holes and no holes punched. Two other patterns should be tried, FF FF to punch all holes, and 55 AA to punch alternate holes. After the stack pointer is initialized, the character to be punched is loaded into the B

register. Then a call is made to the punch subroutine. This sequence is repeated and then a branch to repeat the punch pair.

The subroutine first pulses the power-on line and then loops on the busy status. The busy status will be returned if either the punch is in the process of powering-on, or still busy with punching the previous character. Programming of this nature will allow for concurrent operation of the punch and the computer. When the punch is not busy, the character is placed on output port 5 and the request punch line of port 4 is strobed. This causes the punch operation to commence and subroutine returns to the caller.

# CONCLUSION

The interface is very simple to build and will provide the owner of a BRPE punch with all of the paper tape that he could ever desire. Happy punching!



Computer Machine Service is ready to supply full service contracts on a variety of microprocessors and associated equipment. CMS is available for assembly work and system configurations. CMS also has a Basic to run on iCOM Disc units at a LOW PRICE of \$50.00 and more software coming.

MICROPROCESSORS: Full service contracts at LOW rates and time and materials service available.

**EQUIPMENT: ALTAIR** 

**IMSAI** 

LSI 11/03

COMPAL-80

and the list goes on.

PERIPHERALS or DATA COMMUNICATIONS

EQUIPMENT: Full service contracts and Board Repair available on TELRAY CRT'S, ADM III, LA 36 DE (DEC WRITER), IMSAI, ALTAIR, COM-PAL-80, EXCEL PRINTERS, etc . . . .

CMS has a full line of computer supplies (ribbons, diskettes, certified digital cassettes), and computer components: 2708, 1702, 8080, etc...



# omputer Machine Service

2909 Oregon Court, Torrance, CA 90503

Sales 213-328-9740

Service 213-328-9760

# You have to SEE it to BELIEVE it!

The Alpha Microsystems AM-100 is LIGHT YEARS ahead of everything else you've seen so far in the low cost computing field.

For a FRACTION of what you'd normally pay for the SOFTWARE ALONE, you get a 16-bit processor with ALL of these BIG-SYSTEM capabilities:

# MULTI-TASKING, MULTI-USER TIMESHARING

- **☆ DEVICE INDEPENDENT I/O**
- **☆ ADVANCED FILE STRUCTURE**
- ☆ POWERFUL SYSTEM COMMANDS
- **☆SOPHISTICATED TEXT EDITOR**
- ☆ FULL MACRO ASSEMBLER
- **☆LINE PRINTER SPOOLER**
- ☆ RE-ENTRANT, MULTI-USER BASIC COMPILER
- **☆LARGE UTILITIES LIBRARY**

# Yet, with all this it's still compatible with the S-100 BUS!

If you like the Decsystem-10 operating system, if you like TECO . . . if you like the PDP-11 instruction set . . . you'll LOVE the AM-100!

\$1495 IN STOCK NOW!

# NOWAT

# BYTE SHOP

of Pasadena

496 S. LAKE AVE. ФАSADENA, CA. 91101 PHONE: (213) 684-3311

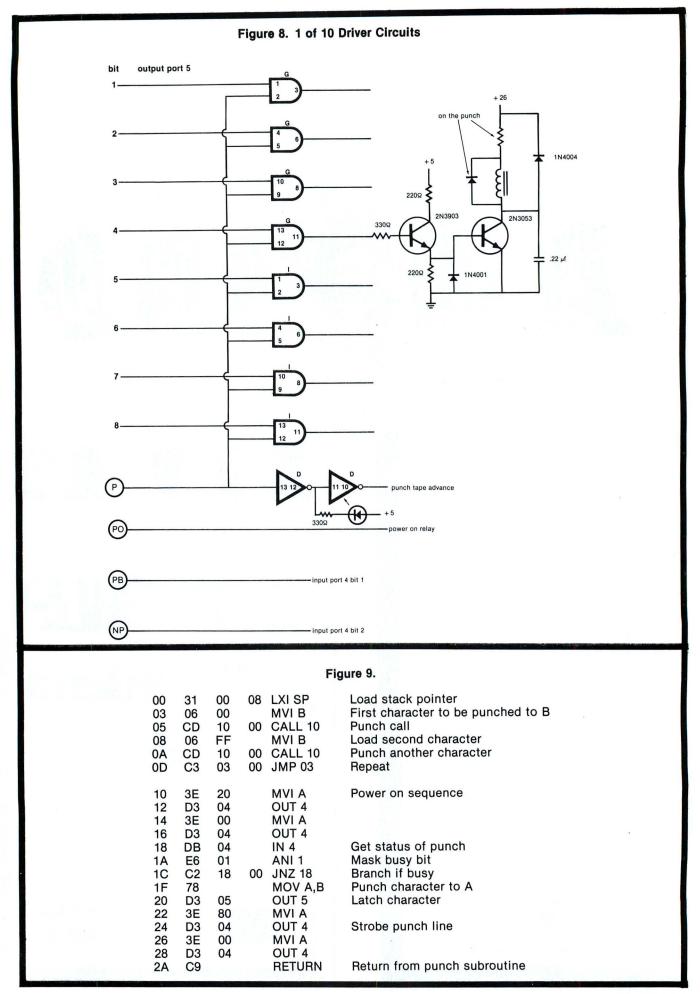
HOURS: Tuesday — Friday, 12:00 — 9:00; Saturday & Sunday, 12:00 — 5:00;

Closed Mondays





AUGUST 1977 CIRCLE INQUIRY NO. 67 NTERFACE AGE 149



**Buy Your Computer Off the Shelf** 



What you don't see on our shelves here, you'll probably find a few feet away. Our stores are stocked with computers, components, peripherals and supplies from every major manufacturer. If you can't come to us, we'll ship to you . . . anywhere.

At Two Locations:

# **COMPUTER COMPONENTS**

5848 Sepulveda Blvd., Van Nuys, CA 91411 (213) 786-7411 4705 Artesia Blvd., Lawndale, CA 90260 (213) 370-4842 10-9 Tue.-Fri. Closed Monday 10-6 Sat.-Sun.

# **Software Section**

# **SUMMARY OF AUGUST SOFTWARE**

The software lineup for the August issue of INTER-FACE AGE includes four software articles, featuring two development programs, a program conversion article, and two game programs. These articles are as follows:

- HIGH DENSITY BINARY TAPE LOAD (BILOAD) Program by permission and courtesy of Motorola's M6800 Users Group Library. This program provides a driver routine to load binary formatted object paper tape programs into memory by way of a TTY.
- HIGH DENSITY BINARY TAPE PUNCH (BI PUNCH)
  Program by permission and courtesy of Motorola's
  M6800 Users Group Library. This program provides a
  companion routine for BILOAD to Dump binary formatted object code from memory to TTY punch with
  automatic punch control.
- FORTRAN TO BASIC CONVERSIONS by W. C. Thompson provides some insight into converting FORTRAN applications programs over to the BASIC format for running.
- TIC-TAC by Bud Shamburger provides the game of the month program.
- CRAZY BALL by Elliott Myron provides a game of skill for your 8080 microprocessor.

# **EXMON PROGRAM SOFTWARE BUGS**

Three of our ardent readers provide correction to bugs discovered in EXMON

# Dear Editor:

Here is a patch to fix "X" command in EXMON 6800, April 1977.

# CORRECTIONS

| Change | IEEA | 7E 0F 84 |
|--------|------|----------|
| Enter  | IF84 | 08       |
|        | IF85 | 7E E0 C8 |

The "X" command wasn't such a bad error for it just read out the wrong value while the correct value was in the INDEX register, but a more critical error was the fact that MIKBUG® stacks the registers in the following order CC, B, A, X, P, S, so EXMON as printed put contents of CC register into A, and A into CC.

### CORRECTIONS

| Change | IE6C | C1 43 |
|--------|------|-------|
| Change | IE76 | C1 41 |

example:

: A AA

:BBB

:CCC

:XDD EE

A register printout would look like this

: R CC BB AA DDEE IE00 A042

which is correct.

W. E. Mathews

# Dear Editor:

I would like to thank Mr. Michael Burton for sav-

ing me from reinventing the wheel. His EXMON program in the April issue came at a time when I was considering writing something similar myself.

I loaded it immediately and found it to be a real time saver in debugging.

However, one little bug managed to sneak into the EXMON program. When you call up a display of the index register using the X command, you get instead the conditions code register in XHI position and XHI in XLO position. To illustrate, assume the CC register contains 12 and the X register contains ABCD. On executing 'X', the display will show 12AB instead of ABCD.

The reason for this is that the index register is still pointing at CC when jumping to the OUT4HS routine. An INX instruction between BNE CHKS (Addr. 1E8B and 1E8C) and BSR OUT4HS will correct the situation.

Jack DuMoulin

# MICROCOMPUTER SOFTWARE DEPOSITORY PROGRAM LISTING

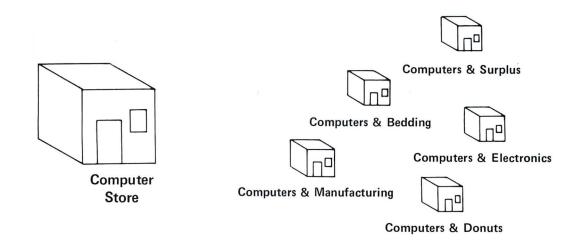
The following lists software available from MSD on a prepaid basis only. The total cost of each package is the sum of the basic price + California sales tax, if applicable + postage and handling cost. Foreign subscribers, please note the different mailing cost for postage outside USA. Address all inquiries to:

Microcomputer Software Depository 2361 E. Foothill Blvd. Pasadena, CA 91107 or call (213) 449-0616.

MICROCOMPUTER SOFTWARE DEPOSITORY (MSD.) PROGRAMS DATE AUGUST 1977

| MICRO  | COMPUTER SOFTWA | ARE DEPOSITORY | (MSD) H  | PROGRAMS  | DATE AUGUST 1977         |
|--------|-----------------|----------------|----------|-----------|--------------------------|
| PROGRA | M MEDIA         |                |          | NOTES     |                          |
| PTAC   | PAPER TAPE ASS  | EMBLY CODE     |          |           | IF. SALES TAX REQUIRED   |
|        | PAPER TAPE SOL  |                |          |           | OM RESIDENCE OF CALIF.   |
|        | PAPER TAPE OB.  |                |          |           |                          |
| PTRC   | PAPER TAPE BAS  |                |          |           | A POSTAGE + HANDLING OR  |
|        |                 |                |          |           | IRD CLASS USA POSTAGE +  |
| PTAL   | PAPER TAPE ASS  |                |          |           | NDLING OR SURFACE RATE   |
| PTSL   | PAPER TAPE SOL  |                |          |           | REIGN POSTAGE .          |
| PTOL   | PAPER TAPE OB.  |                |          |           | REE TIMES THIRD CLASS    |
| HLUD   | PAPER TAPE OR.  |                |          |           | A POSTAGE RATE (STANDARD |
| PTHI.  | PAPER TAPE BAS  |                |          |           | SURFACE RATE FOREIGN     |
| CTAL   | CASSETTE TAPE   |                |          |           | STAGE @ FIVE TIMES USA   |
| CTSL   | CASSETTE TAPE   |                |          | PO.       | STAGE KATE (ALTERNATE)   |
| CTOL   | CASSETTE TAPE   |                | G        |           | W PROGRAM LISTING        |
| CTOD   | CASSETTE TAPE   |                |          | % VE      | NDOR SOFTWARE PACKAGE -  |
| CTBC   | CASSETTE TAPE   | BASIC CODE     |          |           |                          |
| CTBL   | CASSETTE TAPE   | BASIC LISTING  |          |           |                          |
| HCAC   | XEROX HARD COL  | Y OF ASSEMBLY  | CODE     |           |                          |
| HCSC   | XEROX HARD COR  | Y OF SOURCE C  | ODE      |           |                          |
| HCOC   | XEROX HARD COR  | Y OF OBJECT C  | ODF      |           |                          |
| HCRC   | XEROX HARD COL  |                |          |           |                          |
| HCAL   | XEROX HARD COL  | Y OF ASSEMBLY  | LISTING  | G         |                          |
| HCALF  | FULL SIZE XER   | X HARD COPY O  | F ASSEME | BLY LIST  | ING                      |
| HCSL   | XFROX HARD COL  | Y OF SOURCE L  | ISTING   |           |                          |
| HCOL.  | XEROX HARD COL  |                |          |           |                          |
| HCOD   | XFROX HARD COL  |                |          |           |                          |
| HCBL   | XEROX HARD COL  |                |          |           |                          |
| TFXT   | XEROX HARD COL  |                | TFXT     |           |                          |
| PTTL   | PAPER TAPE TEX  |                |          |           |                          |
| CTTL   | CASSETTE TAPE   | TEXT LISTING   |          |           |                          |
| MAN    | MANUAL          |                |          |           |                          |
| HCGK   |                 |                |          |           |                          |
| PTGR   |                 |                |          |           |                          |
| BRSL   | XEROX HARD COL  |                |          |           |                          |
| HR SL  | XEROX HARD COL  |                |          |           |                          |
| PACK   |                 |                | ITEMS/PI | ROGRAM #  | WITH SYMBOL <            |
| FDOD   | FLOPPY DISC OF  |                |          |           |                          |
|        |                 | ASSEMBLED CO   |          |           |                          |
|        |                 | PUTER FORMATED |          |           |                          |
|        |                 | E DUMP IN OCTA | L OR HE  | X         |                          |
|        | SUFFIX F= FULI  | L SIZE COPYY   |          |           |                          |
| DEFIN  | ITIONS;         |                |          |           |                          |
|        |                 |                |          |           |                          |
| ASS    | EMBLY LISTING:  | COMPUTER ASSE  | MBLED SO | DETWARE   | PROGRAM LISTING          |
|        |                 | THAT INCLUDES  | SYMBOL   | IC ASSEM  | BLY LANGUAGE SOURCE      |
|        |                 | CODED INSTRUC  | TIONS W  | ITH COMM  | ENTS PLUS                |
|        |                 | EQUIVALENT MA  | CHINE LA | ANGUAGE I | DBJECT CODED             |
|        |                 | INSTRUCTINS A  | ND MEMOI | RY ADDRE  | SS ASSIGNMENTS FOR       |
|        |                 | EACH INSTRUCT  | 10N ( SC | DURCE +   | DBJECT ).                |
| ASS    | FMBLY CODE:     | SAME CONTENT   | AS ASSEM | MBLY LIS  | TING BUT HAND ASSEMBLED. |
|        |                 |                |          |           |                          |
| 57!1   | RCF LISTING:    |                |          |           | ULTING FROM COMPUTER     |
|        |                 |                |          |           | PROCESS THAT INCLUDES    |
|        |                 |                |          |           | ED INSTRUCTIONS WITH     |
|        |                 | COMMENTS. SOM  | FTIMES,  | LINE ST   | ATEMENT NUMBERS ARE      |
|        |                 |                |          |           |                          |

# WE SPECIALIZE, OTHERS DON'T



If you have two businesses, you give half your attention to each of them, right? We have only one business, we're The Computer Store. Come to us for sound advice, we're

# THE MOST EXPERIENCED COMPUTER DEALERS ANYWHERE

# THE COMPUTER STORE

820 Broadway Santa Monica, Calif. 90401 Phone (213) 451-0713

Store hours: Tues-Fri: Noon  $-8 \, \mathrm{pm}$ 

Saturday: 10 am - 6 pm

Located 2 blocks North of the Santa Monica Freeway at the Lincoln Blvd, exit



Authorized dealer for MITS, Cromemco, MECA, Logistics, Microterm, Technical Design Labs, Micro Computer Devices, North Star, Multiterm, Heuristics, Peripheral Vision, Oliver, Hitachi, Sanyo. BankAmericard and Master Charge welcome.



# Isn't it time . . . you had your own personal computer?

Read BUTE, the leading national publication covering the fantastic new field of personal computer applications. Today, large scale integration has made it possible for the individual to enjoy the unique benefits of a general purpose computing system. Now, an entire micro industry markets microcomputer related items, products that range from computer system kits to peripherals, software and literature on the subject. But where should you go for all the details about your personal involvement in computer technology?

**Read BUTE**, the Small Systems Journal devoted exclusively to microcomputer systems. Every issue a monthly compendium of lively articles by professionals, computer scientists, and serious amateurs.

- Detailed hardware and software design articles authored by individuals who are experimenting in the field.
- Tutorial background articles on hardware, software and applications ideas for the home computer and general topics of computer science.
- Reviews of processors as candidates for small general purpose systems.
- An editorial bias toward the fun of using and applying computers toward personally interesting problems such as electronic music, video games, control of systems for hobbies from ham radio to model railroading, uses of computers from burglar alarms to private information systems.
- Advertisements of the firms who bring you products to help expedite your personal computing activities.
- Information on clubs, newsletters and other social activities of the individuals engaged in personal computing.

**Don't miss a single EUTE**, Order your subscription today by filling in this coupon, or phone your request directly — call 603/924-7217 and ask for subscription department.

Read your first copy of BYTE from cover-to-cover. If it's everything you expected, honor our invoice. If it isn't, just write 'CANCEL' across the invoice and send it back. You won't be billed and the first issue is yours to keep.

Allow 4 to 6 weeks for processing

|                               |                                      | orough, N.H. 03458   |
|-------------------------------|--------------------------------------|----------------------|
|                               | ☐ \$22 Two Years<br>☐ Check Enclosed | ☐ \$30 Three Years   |
| ☐ Bill BankAmericard          | U Check Enclosed                     | ☐ Bill Master Charge |
| Credit Card Number            |                                      |                      |
| Credit Card Expiration Date _ |                                      |                      |
| Name (Please Print)           |                                      |                      |
| Address                       |                                      |                      |
| City                          | State                                | Zip                  |

|                                 | INCLUDED FOR FACH INSTR   | UCTION.  | 4502     | APPLECD | 6502 APPLE COMPUTER   |  |  |
|---------------------------------|---|--|----------|---------|---|--|--|
| SOURCE COOF:                    |   | LISTING BUT HAND ASSEMBLE  |          |         | DISASSEMBLER BY ALLEN BAUM<br>& STEPHEN MOZNIAK-INTERFACE<br>AGE, SEPT. 1976, VOL.1,#10.                        | 1-TEXT <<br>1-HCAL <<br>1-PACK +               | 5.00+0.30+1.00<br>INC. WITH TEXT                                     |
| OFFICE STATES                   | SOFTWAFF CONTROLLED ASS<br>INCLUDES MACHINE READAR<br>AND MEMORY ADDRESS ASSI | G RESULTING FROM COMPUTER<br>FMALY PROCESS THAT ONLY<br>LE ORJECT CODED INSTRUCTI<br>GNMENTS.<br>LISTING BUT HAND ASSEMBLE | ONS 8080 | LPTIIHF | LOAD BORD PAPER TAPE IN<br>INTEL HEX FORMAT BY BURT<br>HASHIZUME-INTERFACE AGE,<br>OCT. 1976, VOL.1,#11.        | 2-PTAL < 0<br>2-PTOD <<br>2-TEXT <<br>2-HCAL < | 8.00+0.48+2.00<br>INC. VITH PTAL<br>3.00+0.18+1.00<br>INC. VITH TEXT |
| HAFF CORY:                      | XEROX DE PRINTED COPY.  |  | вава     | BF 40A  | BOBO BINARY FILES WITH  | 3-PTAL < N                                     | 8.00+0.48+1.00   |
| cone:                           | HAND ASSEMBLED CODE ( S   | OURCE, OBJECT, OR ASSEMBL  | Y        |         | OPTIONAL AUTOSTART BY WILLIAM H. JORDAN-INTERFACE AGE, OCT. 1976, VOL.1,#11.                                    | 3-PTOD <                                       | INC. WITH PTAL<br>3.00+0.18+1.00                                     |
| LISTING:                        | COMPUTER FORMATED LISTE   | NG.  |          |         |   | 3-HCAL <<br>3-PACK +                           | INC. WITH TEXT   |
| DIM#:                           | COMPUTER MEMORY DUMP.   | •••••  |          | MINOPS  | MIN OPERATING SYSTEM BY ED<br>KEITH & DENNIS HESCOX-<br>INTERFACE AGE, OCT. 1976,<br>VOL.1, #11. PTAL+ INCLUDES | 4-PTAL+< 0<br>4-PTOD <                         | 8.00+0.48+2.00<br>INC. WITH PTAL<br>2.00+0.12+1.00                   |
| MSD PROGRAMS                    |   |  |          |         | OPERATING INSTRUCTIONS,<br>PAPER TAPE FORMAT AND  | 4-HCAL <                                       | INC. WITH TEXT   |
| CPU SYMBOLIC DE<br>TYPE NAME NA | SCRIPTIVE<br>ME   | MSD # & P R PRICE IN MEDIA A E +CALIF. T C V +USA POST   | AX(*)    | DRRDP   | DR. BEATTIE'S BASIC DIFT<br>PLANNING BY DR. BEATTIE-<br>INTERFACE AGE, OCT. 1976,                               | 5-TEXT < 0<br>5-HCBL <<br>5-PTBL <             | 3.00+0.18+1.00<br>INC. WITH TEXT<br>8.00+0.48+2.00                   |

# Cancer's warning signals:

1.

Change in bowel or bladder habits.

2.

A sore that does not heal.

3.

Unusual bleeding or discharge.

4.

Thickening or lump in breast or elsewhere.

5.

Indigestion or difficulty in swallowing.

6.

Obvious change in wart or mole.

7.

Nagging cough or hoarseness.

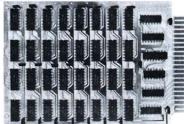
If you have a warning sign, see your doctor!

# AMERICAN CANCER SOCIETY \*

This space contributed by the publisher.

# SALE IS OVER

But don't worry. The sale went so good we are making the offer permanent. Buy 4 high speed-low power static RAM Board kits at 79.95 each and an 8 slot Mother Board is yours **FREE**. Board comes with 4 sockets.



# **4K RAM BOARD KIT**

450ns Access RAMs Fully Buffered Low Power Static 5V only 4½x6 inch board

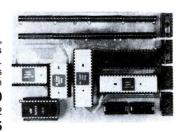
\$79.95

6800 CPU PROTOTYPE BOARD

Plated thru holes for CPU, address decoder, 2 PIAs, 2 RAMs, 6 spare 16 pin and 4 spare 24 pin sockets to easily customize your own homebrew system. Board is fully socketed with gold wirewrap sockets & comes with full minimum system documentation

\$42.50

Above Board with 6800, address decoder, 2 PIAs and 2 RAMs: \$84.95



| CONTINE | NTAL SPECIAL | TIES PRODUCTS | UNGAR SOLDERING PRODUCTS |            |                  |  |  |
|---------|--------------|---------------|--------------------------|------------|------------------|--|--|
| ITEM    | LIST PRICE   | OUR PRICE     | ITEM                     | LIST PRICE | <b>OUR PRICE</b> |  |  |
| Exp300  | 9.95         | 8.00          | 50T8                     | 41.67      | 33.00            |  |  |
| Exp600  | 10.95        | 9.25          | 50T7                     | 41.67      | 33.00            |  |  |
| QT59S   | 12.50        | 10.00         | 50T6                     | 41.67      | 33.95            |  |  |
| QT59B   | 2.50         | 2.00          | Kit 42                   | 7.50       | 6.25             |  |  |
| PB100   | 19.95        | 15.95         | Kit 27                   | 6.72       | 5.75             |  |  |
| PB101   | 29.95        | 23.95         | 6903                     | 8.57       | 7.25             |  |  |
| PB102   | 39.95        | 31.95         | 6915                     | 7.60       | 6.49             |  |  |
| PB103   | 59.95        | 41.95         | 8000                     | 3.67       | 3.25             |  |  |
| DM-4    | 124.95       | 107.95        | 7800                     | 21.15      | 17.25            |  |  |
| LM-1    | 74.95        | 59.95         | 7825                     | 12.37      | 10.50            |  |  |
| LP-1    | 44.95        | 35.95         | 135                      | 9.58       | 7.75             |  |  |

LOW POWER 2102's 450 n.s. . . . \$1.30 each Multiples of 25 only

"See us at Booth 712 in Boston"

MAKE CHECK OR MONEY ORDER PAYABLE TO: Kathryn Atwood Enterprises P.O. Box 5203, Orange, CA 92667

Discounts available at OEM quantities. For orders less than \$25.00 total, add \$1.25 for shipping. California residents add 6% sales tax. Estimated shipping time 2 days ARO with money order. For checks allow 7 days for check to clear.

SOFTWARE SECTION SOFTWARE EDITORIAL

| 6800 | EZMERPS  | VOL.1,#11.  ECHO 1, ZERO MEMORY, ECHO REVERSE & PRINT SUBROUTINES  | 5-PACK + 6-PTAL < 0   | 5.00+0.30+1.00  | 6800  | RABSIMB   | RELATIVE ADDRESS BACK-<br>STEPPER IN MICRO-BASIC<br>BY J. HUFFMAN - INTERFACE   | 25-PTBL < 0<br>25-HCBL <<br>25-TEXT <                          | 5.00+0.30+1.00<br>1.00+0.06+1.00<br>INC. WITH HCBL                     |  |
|------|----------|--|---|---|-------|-----------|---|--|--|--|
|      |          | BY HOMARD BERENBON-<br>INTERFACE AGE, OCT. 1976,<br>VOL.1,#11.   | 6-TEXT <<br>6-HCAL <<br>6-PACK +                                | 1.00+0.06+1.00<br>INC. WITH TEXT  | 6800  | TEFT 6800 | AGE, DEC. 1976, VOL.1,#13.  TEXT FDITOR FOR THE SWTPC- 6800 BY MARK BORGERSON - INTERFACE AGE, DEC. 1976,                                 | 25-PACK +<br>26-PTAL < 0<br>26-PTOD <<br>26-HCAL <             | 15.00+0.90+2.00<br>10.00+0.60+2.00<br>3.00+0.18+1.50                   |  |
| 8080 | FSP-1    | ESP-1 SOFTWARE PACKAGE BY<br>MICHAEL SHRAYER-INTERFACE<br>AGE, OCT. 1976, VOL.1,#11.<br>PTGR IS PAPER TAPE COPY OF         | 7-PTOD < %0<br>7-MAN <<br>7-CTOD <<br>7-MAN <                   | 30.00+1.80+1.50<br>INC. WITH PTOD<br>30.00+1.80+1.50<br>INC. WITH CTOD                  | 8080  | WPATBX    | VOL.1.#13. HCAL IS COPY OF<br>FULL SIZE ASSEMBLY LISTING.<br>WANG'S PALO ALTO TINY BASIC  | 26-PACK +  | 2.00+0.12+1.25   |  |
|      | Deco. I  | GRAMMAR.   | 7-PTGR <<br>7-HCGR <<br>7-PACK †                                | 5.00+0.30+1.50<br>INC. WITH PTGR  |       |           | BY ROGER RAUSKOLB - INTERFACE AGE, DEC. 1976, VOL.1,#13. HCAL & HCSL ARF COPIES OF FULL SIZE CODE   | 27-PTOD <<br>27-HCAL <<br>27-TEXT <<br>27-HCSL <               | 10.00+0.60+2.00<br>4.00+0.24+1.50<br>INC. WITH HCAL<br>4.00+0.24+1.50  |  |
| нини | PTSP-1   | PROCESSOR TECHNOLOGY<br>SOFTWARE PACKAGE NO. 1<br>SUMMARY BY R. A. STEVENS-<br>INTERFACE AGE, OCT. 1976,<br>VOL.1,#11.     | B-PTGR <%0<br>B-TEXT <<br>B-PACK +                              | 5.00+0.30+1.50<br>INC. WITH PTTL  | 8080  | LLLBI     | LLL 8080 BASIC INTEMPRETER<br>GRAMMAR BY JERRY BARBER &<br>ROYCE ECKARD - SUBMITTED BY<br>F.K. FISHER - INTERFACE AGE,                    | 27-PACK +<br>28-TEXT1< 0<br>28-PTSL2<<br>28-HCAL2<             | 5.00+0.30+2.00<br>57.00+3.42+6.00<br>5.00+0.30+2.00<br>3.00+0.18+2.00  |  |
| 8080 | ERAMMT   | EXHAUSTIVE 8080 RAM MEMORY<br>TEST PROGRAM BY T.E.TRAVIS<br>-INTERFACE AGE, NOV. 1976,                                     | 9-PTAL < 0  | 6.00+0.36+2.00<br>INC. WITH PTAL  |       |           | DEC. 1976, VOL. 2, #1 (PART 1). JAN. 1977, VOL. 2, #2 (PART 2), FEB. 1977, VOL. 2, #3 (PART 3), MARCH 1977, VOL. 2, #4 (PART 4).          | 28-PTSL3<<br>28-HCAL3<<br>28-TEXT3<                            | 36.00+2.16+4.00<br>5.00+0.30+2.00<br>3.00+0.18+2.00                    |  |
|      |          | VOL-1,#12.   | 9-TEXT <<br>9-HCAL <<br>9-HCOD <<br>9-PACK +                    | 2.00+0.12+1.00<br>INC. WITH TEXT<br>INC. WITH TEXT                                      |       |           | TEXTI IS PART 1, TEXT2 IS<br>PART 2, ETC. HCAL2,3, & 4<br>ARE FULL SIZE XEROX COPIES<br>OF ASSEMBLY PROGRAM LISTINGS                      | 28-TEXT4<<br>28-HCAL4<<br>28-PACK +                            | 15.00+0.90+2.00<br>3.00+0.18+2.00<br>3.00+0.18+2.00                    |  |
| 6800 | MEMDMP-1 | SWTPC 6800 MEMORY DUMP<br>PROGRAM MEMDMP-1 BY GARY   | 10-PTAL < 0<br>10-PTSL < 0                                      | 5.00+0.30+1.00<br>8.00+0.48+1.00  | SC/MP | NIBL      | OF PARTS 2,3, & 4. NIBL-NATIONAL'S TINY BASIC   | 29-TEXT < 0  | 5.00+0.30+2.00   |  |
|      |          | KAY-INTERFACE AGE, NOV-<br>1976, VOL-1,#12.  | 10-PTOD <<br>10-TEXT <<br>10-HCAL <<br>10-PACK +                | INC. WITH PTSL<br>1.00+0.06+1.00<br>INC. WITH TEXT                                      |       |           | GRAMMAR FOR SC/MP BY PHIL<br>ROYBAL - INTERFACE AGE, DEC.<br>1976, VOL.2, #1. ASSEMBLY<br>LISTING PUBLISHED JAN. 1977,<br>VOL.2,#1.       | 29-PTOD <  | 10.00+3.00+2.00<br>10.00+3.00+2.00<br>5.00+0.30+1.00<br>2.00+0.12+1.00 |  |
| 6800 | ROBIT-1  | SWTPC 6800 ROTATING BIT<br>RAM MEMORY DIAGNOSTIC<br>PROGRAM ROBIT-I BY GARY<br>KAY-INTERFACE AGE, NOV-<br>1976, VOL-1,#12- | -PTAL   | 5.00+0.30+1.00<br>8.00+0.48+1.00<br>INC. WITH PTSL<br>1.00+0.06+1.00<br>INC. WITH TEXT  | SC/MP | MINBAGELS | BAGELS BY DR. MARVIN -<br>WINZINREAD BY PERMISSION<br>& COURTESY OF NATIONAL<br>SEMICONDUCTOR - INTERFACE                                 | 30-PTBL < 0  | 5.00+0.30+2.00   |  |
| 6800 | MEMCON-1 | SWTPC 6800 SHORT MEMORY  | 11-PACK +<br>12-PTAL < 0  | 5.00+0.30+1.00  |       |           | AGE, DEC. 1976, VOL.2,#1.   |  |  |  |
|      |          | ADDRESS CONVERGENCE<br>PROGRAM MEMCON-1 BY GARY<br>KAY-INTERFACE AGE, NOV-<br>1976, VOL.1,#12.                             | 12-PTSL < 0<br>12-PTOD <<br>12-TEXT <<br>12-HCAL <<br>12-PACK + | 8.00+0.48+1.00<br>INC: WITH PTSL<br>1.00+0.06+1.00<br>INC: WITH TEXT                    | 8080  | AMSBØ     | AMSAT RMRM STANDARD DEBUG<br>MONITOR BY HICHARD C ALLEN<br>& JOE KASSER - BYTE # 13,<br>SEPT. 1976, VOL.2,#1.<br>SUBMITTED BY JOE KASSER. | 31-PTSL < 2<br>31-PTOD <<br>31-PACK +                          | 15.00+0.90+2.00<br>5.00+0.30+2.00                                      |  |
| 6800 | RJIR     | BLACKJACK IN BASIC<br>PROGRAM BY ED KEITH &<br>DENNIS HESCOX. THE BJIB<br>PAPER TAPE OBJECT CODE                           | 13-PTBL 0<br>13-PTBL+<  | 9.00+0.54+2.00  | 6800  | BAFCMP    |   | 32-PTBL < 1<br>32-TEXT <<br>32-PACK +                          | 6.00+0.36+1.00   |  |
|      |          | REQUIRES ROBERT<br>UITERWYK'S SWTPC  | 13-HCBL <   | 2.00+0.12+1.00<br>INC. WITH TEXT  | 2000  | 5050      | JAN. 1977, VOL.2,#2.  |  |  |  |
|      |          | MICROBASIC OPERATING SYSTEM-INTERFACE AGE, NOV. 1976, VOL.1.#12. PTBL+ INCLUDES SAMPLE RUN, INSTRUCTIONS, LIST OF          | 13-PACK +   |   | виви  | ECMSO     | MICROCOMPUTER STOCK OPTIONS<br>BY EDWARD CHRISTIANSON -<br>INTERFACE AGE, FEB. 1977,<br>VOL.2,#3.   | 33-PTBL < 0<br>33-HCBLF<br>33-HCBLF<<br>33-TEXT <<br>33-PACK 1 | 15.00+0.90+2.00<br>5.00+0.30+2.00<br>INC. WITH PTBL<br>5.00+0.30+2.00  |  |
|      |          | VARIABLES AND LIST OF<br>ROUTINES.   |   |   | 8080  | BMRNG     | RANDOM NUMBER GENERATOR<br>BY BOB MARTIN - INTERFACE  | 34-PTAL < 0<br>34-PTSL <                                       | 7.00+0.42+2.00   |  |
| 6502 |          | REVISED FLOATING POINT<br>ROUTINES FOR 6502* BY<br>ROY RANKIN & STEVE<br>WOZNIAK - INTERFACE AGE,<br>NOV. 1976, VOL.1,#12. | 14-PTOD < 1<br>14-PTAL <<br>14-PTSL <<br>14-TEXT <<br>14-HCAL < | 5.00+0.30+1.00<br>9.00+0.54+2.00<br>10.00+0.60+2.00<br>2.00+0.12+1.00<br>INC. WITH TEXT |       |           | AGE, FEB. 1977, VOL.2,#3.   | 34-TEXT <<br>34-HCALF<br>34-HCALF<<br>34-PACK †                | 6.00+0.36+2.00<br>2.00+0.12+1.00<br>4.00+0.24+1.00<br>INC. WITH PTAL   |  |
|      |          | NOTF * - ORIGINAL MATH<br>PACKAGE FIRST APPEARED IN<br>DR. DOBB'S JOURNAL, AUG.<br>1976, VOL.1,#7.                         | 14-PACK t   | INC. WITH TEXT  | 8080  | RNDFGCST  | RND FUNCTION GENERATOR<br>CHI-SOHARF TEST PROGRAM<br>BY BOB MARTIN - INTERFACE<br>AGE, FEB. 1977, VOL.2,#3.                               | 35-PTBL <<br>35-HCBLF<<br>35-PACK 1                            | 4.00+0.24+1.00<br>INC. WITH PTBL                                       |  |
| 6800 | HISPDMUP | HIGH SPEED DOUBLE PRECISON<br>MULTIPLICATION SUBROUTINE-<br>HISPDMUP BY PERMISSION AND                                     | 15-PTAL < 0   | 8.00+0.48+1.00  | 8080  | TTMOCSR   | SEARCH ROUTINE BY T. E.<br>TRAVIS - INTERFACE AGE,  | 36-PTAL < 0<br>36-PTSL <<br>36-TEXT <                          | 5.00+0.30+1.00<br>5.00+0.30+1.00<br>1.00+0.06+1.00                     |  |
|      |          | COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, NOV. 1976, VOL.1,#12.                                      | 15-TEXT <<br>15-HCAL <<br>15-PACK +                             | INC. WITH TEXT  | 8080  | TDOMP     | FFB. 1977, VOL.2,#3.  8080 OCTAL MONITOR PROGRAM  | 36-HCALF<br>36-HCALF<br>36-PACK +                              | INC. WITH TEXT<br>2.00+0.12+1.00<br>8.00+0.48+2.00                     |  |
| 6800 | DIVI6    | REENTRANT 16 BIT DIVIDE<br>SUBROUTINE - DIVI6 BY   | 16-PTAL < 1   | 8.00+0.48+1.00  | 3000  |           | BY THOMAS E. DOYLE - INTERFACE AGE, FEB. 1977,  | 37-PTSL <<br>37-TEXT <   | 8.00+0.48+2.00<br>8.00+0.48+2.00<br>2.00+0.12+1.00                     |  |
|      |          | PERMISSION AND COURTESY OF MOTOROLA'S M6800 USER GROUP LIBRARY- INTERFACE AGE, NOV. 1976, VOL.1,#12.                       | 16-TEXT <<br>16-HCAL <<br>16-PACK +                             | 1.00+0.06+1.00<br>INC. WITH TEXT  |       |           | VOL.2,#3.   | 37-HCALF<br>37-HCALF<<br>37-PTOD <<br>37-PACK +                | 4.00+0.24+1.00<br>INC. WITH PTAL<br>5.00+0.30+1.50                     |  |
| 6800 | RENTMUP  | REENTRANT DOUBLE PRECISION<br>MULTIPLICATION SUBROUTINE-<br>RENTMUP BY PERMISSION AND<br>COURTESY OF MOTOROLA'S            | 17-PTAL < 0<br>17-TEXT <<br>17-HCAL <                           | 8.00+0.48+1.00<br>1.00+0.06+1.00<br>INC. WITH TEXT                                      | 8080  | LLLBFPMP  | LLLBASIC FLOATING POINT MATH<br>PACKAGE BY DAVID MEAD &<br>MODIFIED BY HAL BRAND AND<br>FRANK OLKEN - INTERFACE                           | 38-TEXT < 0<br>38-HCALF<<br>38-PTSL <<br>38-PACK +             | 3.00+0.18+2.00<br>5.00+0.30+2.00<br>36.00+2.16+4.00                    |  |
|      |          | M6800 USER GROUP LIBRARY-<br>INTERFACE AGE, NOV. 1976,   | 17-PACK +   |   | 90.00 | 700MEDD   | AGE, FEB. 1977, VOL.2,#3. ZRØ MITS 12K EXTENDED BASIC   |  |  |  |
| 8080 |          | VOL.1,#12.  COMPUTER OR CONTROLLER BY TERRY BENSON, INTEL -  | 18-PTAL < 0<br>18-PTSL <  | 5.00+0.30+1.00<br>5.00+0.30+1.00  | doob  | 2004591   | PATCHES BY MARTIN D. GRAY -<br>INTERFACE AGE, MARCH 1977,<br>VOL.2,#4.  | 39-TEXT < 0<br>39-HCALF<<br>39-PACK +                          | 1.00+0.06+1.00   |  |
|      |          | INTERFACE AGE, SEPT. 1976,<br>VOL.1,#10.   | 18-TEXT <<br>18-HCAL <<br>18-PACK +                             | 1.00+0.06+1.00<br>INC: WITH TEXT  | 6502  | RJBAST    | 6502 APPLE STAR-TREK BY<br>ROBERT J. BISHOP -   | 40-TEXT < 0<br>40-HCBL <<br>40-PACK +                          | 3.00+0.18+1.00<br>INC. WITH TEXT                                       |  |
| 8080 | LCST     | STARTREK BY LYNN COCHRAN-<br>INTERFACE, JUNE 1976,<br>VOL.1,#7.  | 19-PTBL < 0<br>19-TEXT <<br>19-HCBL <<br>19-PACK †              | 7.00+0.42+1.00<br>3.00+0.18+1.00<br>INC. WITH TEXT                                      | 6800  | AMIPROTO  | AMI'S PROTO DEVELOPMENT<br>SOFTWARE FOR EVK SERIES<br>PROTOTYPING BOARDS BY<br>PERMISSION AND COURTESY OF                                 | 41-TEXT < 0<br>41-HCALF<<br>41-PACK +                          | 3.00+0.18+1.00<br>5.00+0.30+2.00                                       |  |
| 8080 | WSPG     | WORD SEARCH PUZZLE GENERATOR BY RICHARD S. FDFLMAN - INTERFACE, JULY 1976, VOL.1,#8.                                       | 20-PTBL < 0<br>20-TEXT <<br>20-HCBL <<br>20-PACK +              | 6.00+0.36+1.00<br>2.00+0.12+1.00<br>INC. WITH TEXT                                      |       |           | AMERICAN MICROSYSTEMS EDITED BY R.A.STEVENS- INTERFACE AGE, FEB. 1977, VOL.2,#3.  |  |  |  |
|      |          | BIORHYTHM BY PAUL GREEN -<br>INTERFACE AGE, AUG. 1976,<br>VOL.1,#9.  | 21-PTBL < 0<br>21-TEXT <<br>21-HCBL <<br>21-PACK +              | 6.00+0.36+1.00<br>1.00+0.12+1.00<br>INC. WITH PTBL                                      | 8080  | CONSOL    | CONSOL 1K RESIDENT OPERATING SYSTEM BY PERMISSION AND COURTESY OF PROCESSOR TECHNOLOGY- INTERFACE AGE, JAN. 1977,                         | 42-TEXT < 0<br>42-HCALF<<br>42-PACK +                          | 3.00+0.18+1.00<br>5.00+0.30+2.00                                       |  |
| 8080 | WDBIORHY | BIORHYTHMS IN PRACTICE BY<br>WILLIAM L. DONHAN, M.D<br>INTERFACE AGE, AUG. 1976,<br>VOL.1,#9.                              | 22-PTBL < 0<br>22-TEXT <<br>22-HCBL <<br>22-PACK +              | 8.00+0.48+2.00<br>2.00+0.12+1.00<br>INC. WITH TEXT                                      | 8080  | ODT-80    | VOL.2,#2.  LLL BASIC OCTAL DEBUGGING PROGRAM BY E. R. FISHER-   | 43-TEXT < 0<br>43-HCALF<                                       | 3.00+0.18+2.00<br>5.00+0.30+2.00                                       |  |
| 8080 | REBJ     | BLACKJACK BY RICHARD S.<br>EDELMAN - INTERFACE AGE,<br>AUG. 1976, VOL.1,#9.  | 23-PTBL < 0<br>23-TEXT <<br>23-HCBL <<br>23-PACK +              | 6.00+0.36+1.00<br>1.00+0.06+1.00<br>INC. WITH TEXT                                      | 6800  |           | INTERFACE AGE, MARCH 1977,<br>VOL.2,#4.  RESIDENT 6800 REENTRANT<br>SELF-RELATIVE SUBROUTINE  | 43-PACK +  44-TEXT < 0  44-HCALF<                              | 3.00+0.18+1.00<br>5.00+0.30+2.00                                       |  |
| 8080 | BLUFF    | BLUFF BY PHIL FELDMAN & TOM RUGE - INTERFACE AGE, SFPT. 1976, VOL.1,#10.   | 24-PTBL < 0<br>24-TEXT <<br>24-HCBL <<br>24-PACK +              | 6.00+0.36+1.00<br>1.00+0.06+1.00<br>INC. WITH TEXT                                      |       |           | PACKAGE FOR EVK 6800<br>MICROCOMPUTER BOARDS BY<br>PERMISSION AND COURTESY OF<br>AMERICAN MICROSYSTEMS                                    | 44-PACK +  | 3-20-0-30*Z*VV   |  |

P.O. Box 4430N Santa Clara, CA 95054

**ELECTRONICS** 

6.75

9.95

leyer 8043 14.50 complete with spec. and socket Solar Cells %\*x%\* 1.10

COMPUTER BOARD KITS 8K RAM Board Kit 4K EPROM Kit 1/O Board Kit Extender Board w/connect

\$55.00

\$75.00

 COMPUTER BOARD KITS

 8K RAM Board Kit
 225.00

 4K EPROM Kit
 133.50

 1/0 Board Kit
 44.50

 Extender Board w/connector
 12.50

 Video Interface board kit
 149.95

 16K EPROM board kit w/o PROMS
 85.00

 16K Static RAM board kit
 495.00

16800 Kit II including hex keyboard er supply 235.00 rocomputer Kit 195.00

PC board 7.50 Switches Mom. Pushbutton 50 3 Digit Universal 2 Digit Universal 5 Deprates 5–18 Volt DC to 5 MHz 10,0 125" LED display 10.50

CLOCK MODULES
Complete alarm clocks ready to hook up with transformer and switches. Very compact with 50° and .84° digits MA1002A, Cor E. 80° 8.95° 102P3 Transformer 2.25 MA1010A, Cor E. 84° 11.95° 102P2 Transformer 2.25 Special Itransformer and six switches when purchased wimdoile 2.95° MA1003 car module .3° green fluor. disjaya 21.50°

.600 .357 .500 .500 .800 CA CC CA CC CA

15.00

CLOCK MODULES

(408) 988-1640

| 6800 |          | EDITED BY R.A. STEVENS-<br>INTERFACE AGE, MARCH 1977,<br>VOL.2,#4.  6890 MIKBUG EXTENDED<br>MONITOR SYSTEM BY MICHAEL<br>BUKTON- INTERFACE AGE, | 45-TEXT < 0<br>45-HCALF<  | 2.00+0.12+1.00<br>3.00+0.18+1.50   | 8080         | CRMS   | RYTEMOVER SOFTWARE FOR THE<br>CHOMEMOD BK BYTESAVER BOARD<br>- PERMISSION AND COURTESY<br>OF CROMEMOC FDITED BY HOGER<br>EDFLSON- INTERFACE AGE, JAN.<br>1977, VOL.2,#2.  | 49-TEXT<br>49-HCAL               | ø | 5.00+0.30+1.00<br>INC. WITH TEXT                     |
|------|----------|---|---|--|--------------|--------|---|----------------------------------|---|--|
|      |          | APRIL 1977, VOL.2,#5.   | 45-PTAL <<br>45-PTOD <<br>45-PACK +   | 9.00+0.54+2.00<br>5.00+0.30+2.00   | 8080/<br>Z80 | FNOCDA | 8080/Z80 OBJECT CODE<br>DIS-ASSEMBLER BY FLOYD L.<br>NOFDIN- STANDARD VERSION   | 50-PTOD -<br>50-MAN -<br>50-PACK | < | 40.00+2.40+2.00<br>5.00+0.30+1.00<br>45.00+2.70+3.00 |
| 8080 | LMCOS    | 8080 CASSETTE OPERATING<br>SYSTEM (COS) BY LORIN<br>MOHLER- INTERFACE AGE,<br>APRIL 1977, VOL.2,#5.   | 46-TEXT <<br>46-PTSL <<br>46-HCALF<<br>46-PACK 1  | 3.00+0.18+1.00<br>10.00+0.60+2.00<br>5.00+0.30+1.00  |              |        | HANDLES UP TO IK LABLES & ASSIGNS SYMBOLIC NAMES. ASCII CHARACTER LIST PIN POINTS EMBEDDED TABLES. INCLUDES BOTH ASSEMBLY AND   |                                  |   |  |
| 6800 | MHFTIHFC | MOTOROLA 6800 HEX FORMAT<br>TO INTEL FORMAT SOFTWARE<br>CONVENTER BY FLOYD NORDIN-<br>INTERFACE AGE, APRIL 1977,<br>VOL.2,#5.                   | 47-TEXT < Ø<br>47-PTAL <<br>47-PTSL <<br>47-PTOD <<br>47-HCALF<<br>47-HCODF<<br>47-PACK t | 1.00+0.06+1.00<br>5.00+0.30+2.00<br>5.00+0.30+2.00<br>3.00+0.18+1.00<br>3.00+0.18+1.00<br>INC. WITH HCAL |              |        | SOURCE OUTPUT MODES VIA YOUR OUTPUT DRIVERS. PROGRAM RESIDES AT TOP OF MEMORY. STANDARD VFKSIONS AVAILABLE FOR 16K, 24K, 32K, 4KK AND 64K RYTES OF MEMORY. OTHER VERSIONS WITH ADDITIONA LARLE SPACE AND/OR DIFFERENT | NL                               |   |  |
| 8080 | MMGTEV   | GRAPHICS- THE EASY WAY BY<br>MARVIN MALLON- INTERFACE<br>AGE, MARCH 1977, VOL.2,#4.   | 48-TEXT Ø<br>48-HCBLF   | 3.00+0.18+1.00<br>5.00+0.30+1.00   | 6809         | SHIPMB | MEMORY SIZE ARE AVAILABLE. SMIP'S 6800 MICHOHASIC VER. 1.4 BY ROBERT H.   | 51-PTOD                          | ø | 15.00+0.90+2.00                                      |

# TCOS - 8080 TAPE CASSETTE SOFTWARE **OPERATING SYSTEM**

TCOS = Two Pass Assembler + Line Editor + Monitor

### **FEATURES**

- 14 Commands
- Line Editor
- Tarbell or Marrows Cassette Driver
- VDM Driver or Serial Driver
- Free Format Assembly
- Automatic Tab Expansion
- Up to 256 Symbols
- Complex Expressions
- All Registers Predefined
- Auto Line Numbering
- · Symbol Table is Printed w/Assembly
- Runs in Low Memory
- No Restart Interference (Can be Interrupt Driven)
- Runs in 6K including Symbol Table (memory available to user = 1800H+)
- Translates Lower Case Characters to to Upper Case

# COMMANDS

**ESC** Restart Input and

Terminate List **FNTR** 

Enter HEX from Memory Read HEX from Memory DUMP

FILE Open, Delete, or Assign

File Areas

ASEM(E,S) Assemble Current File

(Error Switch, Symbol Switch)

LIST List Current File to Console

DELT Delete Lines from Current File

Move 256 Bytes of Memory PAGE

SAVE Save a File on Tape LOAD Load File from Tape

LINE Set Line Numbers

List Symbol Table LABL CTRL C Clear VDM (on VDM Version)

Set Speed (on VDM Version) CTRL S

## PRICE

Object Coded Cassette Tape @ \$30.00 + 1.80 Calif. Sales Tax + 2.00 postage & handling. Manual @ 5.00 + .30 Calif. Sales Tax + 1.00 postage & handing.

DEALER INQUIRIES INVITED CALL OR WRITE

# MICROCOMPUTER SOFTWARE **DEPOSITORY**

2361 E. Foothill Blvd., Pasadena, CA 91107 (213) 449-0616

Same day shipment. First line parts only. Factory tested. Guaranteed money back. Quality IC's and other components at factory prices.

CD4007 22 CD40192 3.00

### INTEGRATED CIRCUITS

| 7400TTL            |      | 74LS38N                | 33   | LM377            | 4.50  | CD4008<br>CD4009 | 43   | 74C00<br>74C04 | 33    |                      |              |  |
|--------------------|------|------------------------|------|------------------|-------|------------------|------|----------------|-------|----------------------|--------------|--|
| 7400N              | .17  | 74LS74N                | 38   | LM379            | 5.00  | CD4010           | 43   | 74C10          | 28    |                      | 1            |  |
| 7402N              | 17   | 74LS75N                | .51  | LM380N           | 1.00  | CD4011           | 22   | 74C14          | 2.10  |                      | _            |  |
| 7404N              | 19   | 74LS90N                | .55  | LM381            | 1.60  | CD4012           | 22   | 74020          | .28   |                      |              |  |
| 7409N              | 23   | 74LS93N                | .55  | LM382            | 1.60  | CD4013           | .39  | 74C30          | .28   | MM5314               | 3.90         |  |
| 7410N              | .17  | 74LS95N                | 1.89 | LM703H           | 40    | CD4014           | 94   | 74C48          | 2.95  | MM5314<br>MM5315     | 4.00         |  |
| 7414N              | 63   | 74LS107N               | .38  | LM709H           | 28    | CD4015           | 94   | 74074          | .75   | MM5315               |              | RESISTORS  |
| 7420N              | 17   | 74LS112N               | .38  | LM723H/N         | 50    | CD4016           | .39  | 74076          | 1.40  | MM5316<br>MM5318     | 5.00<br>8.95 | 1/4 watt 5%  |
| 7422N              | 1.39 | 74LS113N               | .38  | LM733N           | 1.00  | CD4017           | 1.00 | 74090          | 1.15  | MM5318<br>MM5369     |              | 10 per type .0:  |
| 7430N              | 20   | 74L5132N               | .79  | LM741CH          | 35    | CD4018           | 1.00 | 74093          | 1.40  | MM5371N              | 2.10<br>5.50 | 25 per type .0.  |
| 7442N              | .50  | 74LS136N               | .38  | LM741N           | 25    | CD4019           | 50   | 74C106         | 2.10  | MM5841               | 10.80        | 100 per type .0  |
| 7445N              | 69   | 74LS151N               | .73  | LM747H/N         | .62   | CD4020           | 1.11 | 74C107         | .85   | MM5865               | 9.00         | KEYBOARDS  |
| 7447N              | 60   | 74LS155N               | 73   | LM748N           | 35    | CD4021           | 1.11 | 74C154         | 3.00  | CT7001               | 5.80         | Hex keyboard   |
| 7448N              | 69   | 74LS157N               | 73   | LM1303N          | 82    | CD4022           | .94  | 74C160         | 1.44  | C17001               | 6.25         | 53 Key ASCII   |
| 7450N              | .17  | 74LS162N               | 1.00 | LM1304           | 1.10  | CD4023           | 22   | 74C192         | 2.40  | C17010               | 6.95         | Keyboard kit   |
| 7474N              | 29   | 74LS163N               | 1.00 | LM1305           | 1.27  | CD4024           | .83  | 74C221         | 2.75  | CT7015               | 7.25         | Fully assembled  |
| 7475N              | 49   | 74LS174N               | 1.03 | LM1307           | 2 00  | CD4025           | 22   | 740905         | 3.00  | MM5375AA/N           | 3.90         | Enclosure  |
| 7485N              | 88   | 74LS190N               | 1.15 | LM1310           | 2.75  | CD4026           | 1.60 | 74C906         | 1.50  | MM5375AB/N           | 4.90         |  |
| 7489N              | 2.00 | 74LS221N               | 1 95 | LM1458           | 59    | CD4027           | 39   | 740914         | 1.95  | 7205                 | 16.50        | Keyer 8043   |
| 7490N              | 43   | 74LS258N               | .73  | LM1800           | 75    | CD4028           | 85   | 740925         | 10.50 | DS0026CN             | 3.75         | complete with  |
| 7492N              | .43  | LINEAR                 |      | LM1812           | 7.50  | CD4029           | 1.11 | 740926         | 10.50 | DS0056CN             | 3.75         | and socket Sol   |
| 7493N              | 43   | CA3045                 | 90   | LM1889           | 3.00  | CD4030           | 22   | 740927         | 10.50 | MM53104              | 2.50         | Motorola M6800   |
| 7495N              | 69   | CA3046                 | .95  | LM2111           | 1.75  | CD4035           | 1.11 | INTERFAC       | c     | IC SOCKET            |              | All parts includir                                     |
| 74100N             | .90  | CA3049                 | 85   | LM2902           | 1.50  | CD4040           | 1.11 | 8095           | .65   | Solder Tin Low       |              | minus power sup  |
| 74107N             | 29   | CA3081                 | 1.80 | LM3900N          | 55    | CD4042           | .77  | 8096           | .65   | PIN 1 UP PIN         | 1UP          | 8080A Microcom   |
| 74121N             | 34   | CA3082                 | 1.90 | LM3905           | 1.75  | CD4043           | .68  | 8097           | .65   | 8 15 24              | .36          | LEDS   |
| 74123N             | .59  | CA3089                 | 2.95 | LM3909N          | 69    | CD4044           | 68   | 8098           | .65   | 14 18 28             | .43          | Red T018 .1  |
| 74125N             | 39   | CA3090AQ               | 4.75 | MC1458V          | .50   | CD4046           | 1.82 | 8109           | 1.25  | 16 20 36             | .58          | Green T018 .2  |
| 74145N             | .69  | LM301AN/AH             | 35   | NE540L           | 2.00  | CD4049           | 39   | 8110           | 4.50  | 18 .27 40            | .61          | Orange T018 2  |
| 74150N             |      | LM305H                 | 87   | NE550N           | 65    | CD4050           | 39   | 8T13           | 3.00  | 22 35                | .01          | Yellow T018 .2   |
| 74151N             | 1.00 | LM307N                 | .35  | NE555V           |       | CD4051           | 1.22 | 8120           | 5.50  | 3 level wire wrap al | lieve on     | Cliplite LED Mos                                       |
| 74154N<br>74157N   | 69   | LM308N                 | 89   | NE556A<br>NE565A | 1.00  | CD4060           | 1.54 | 8123           | 3.10  | MICROPROCESS         |              | (specify red, ambi                                     |
| 74161N             | 87   | LM309H                 | 1.15 | NE566V           | 1 22  | CD4066           | 78   | BT24           | 3.50  | 8080 with data       | 16.00        | CRYSTALS   |
| 74161N<br>74162N   | 87   | LM309K                 | .95  |                  | 1 25  | CD4068           | 35   | BT25           | 3.20  | 8080A with data      | 19.00        |  |
| 74163N             | 87   | LM311H/N               | 90   | NE567V           | 90    | CD4069           | .40  | 8126           | 1.69  | 8212                 | 4.50         | 2 MH2 5 DC   |
| 74103N             | 96   | LM317T                 | 2.95 | 78L05<br>78L08   | 90    | CD4070           | 40   | 8128           | 2.75  | 8214                 | 8.00         | 4 MHz 4 25   |
| 74175N             | 90   | LM318                  | 1.35 | 79L05            | 1.00  | CD4071           | .22  | 8197           | 1.69  | 8216                 | 4.50         | 5 MHz 4.25   |
| 74190N             | 1 15 | LM320K-5               | 1.35 | 78M05            | 75    | CD4072           | 22   | 8198           | 1.69  | 8224                 | 8.50         | 4 MHz 4 25<br>5 MHz 4 25<br>10 MHz 4 25<br>18 MHz 3 90 |
| 74190N             | 87   | LM323K-5               | 6.95 | 75108            | 1.75  | CD4073           | 22   | MOS MEM        |       | 8228                 | 8.50         | 18 MHz 3.90  |
| 74193N             | 85   | LM320K-12              | 1.35 | 75451CN          | 39    | CD4075           | 22   | 2101-1         | 4.50  | 8251                 | 11.95        | 20 MHz 3.90  |
| 74221N             | 1.55 | LM320K-15              | 1.35 | 75452CN          | .39   | CD4076           | 1 75 | 2102-1         | 1.80  | 8255                 | 11.55        | 32 MHz 3.90<br>32768 Hz 4.00                           |
| 74298N             | 1.65 | LM320T-5               | 1.60 | 75453CN          | 37    | CD4078           | .40  | 2107B          | 4.00  | CDP1802CD            | 19.95        |  |
| 74365N             | .66  | LM320T-8               | 1.60 | 75454CN          | 37    | CD4081           | 22   | 2111-1         | 5.00  | CDP1802D             | 25.00        | 1,8432 MHz 6.50  |
| 74366N             | .66  | LM320T-12              | 1.50 | 75491CN          | .50   | CD4082           | .22  | 2112-2         | 10.90 | UART/FIFO            | 20.00        | 3.5795 MHz 1.50  |
| 74367N             | .66  | LM320T-15              | 1.60 | 75492CN          | .55   | CD4116           | 1.30 | 2116B          | 85.00 | AY5-1013             | 5.50         | TRANSFORMERS   |
|                    |      | LM324N                 | 1.24 | 75494CN          | 89    | CD4490           | 5.50 | 2513B          | 8.75  | 3341                 | 6.95         | 12 Volt 300 ma 1                                       |
| 74LS00 TTI         | 28   | LM339N                 | 1.55 | 13434014         | .03   | CD4507           | 1.00 | 21L02-1        | 1.90  | PROM                 | 0.00         | 12.6V CT 600 m   |
| 74LS00N<br>74LS02N | 28   | LM340K-5<br>LM340K-8   | 1.60 | A to D CONVER    |       | CD4508<br>CD4510 | 1.10 | MM5262         | .50   | 1702A                | 3.95         | 12V 250 ma wall  |
|                    | 28   |                        | 1.60 | 8700CJ           | 13.95 |                  | 1.00 | MM5320         | 5.95  | N82S23               | 3.25         | 12V CT 250 ma  |
| 74LS04N<br>74LS05N | 28   | LM340K-12<br>LM340K-15 | 1,60 | 8701CN           | 22.00 | CD4511<br>CD4515 | 2.72 | MM5330         | 5.94  | N82S123              | 4.00         | 24V CT 400 ma  |
| 74LS08N            | 28   | LM340K-24              | 1.60 | 8750CJ           | 13.95 | CD4515           | 1.18 | PD411D-3       | 4.00  | N82S126              | 4.85         | 24V CT 100 ma  |
| 74LS10N            | 28   | LM340T-5               | 1.60 | LD130            | 13.75 | CD4518           | 1.10 | PD411D-4       |       | N82S129              | 4.85         | COMPUTER BOA   |
| 74LS13N            | 46   | LM340T-8               | 1 20 | 9400CJ V to F    | 7.40  | CD4520           | 1.10 | 4200A          | 18.00 | N82S131              | 5.00         | 8K RAM Board K   |
| 74LS14N            | 1.00 | LM340T-12              | 1 20 | CMOS             |       | CD4527           | 1.60 | 91L02A         | 2.50  | 2708                 | 24.50        | 4K EPROM Kit   |
| 74LS20N            | 28   | LM340T-15              | 1.20 | CD34001 Fair.    | .50   | CD4528           | .85  | CLOCKS         |       | DM8577               | 2.90         | I/O Board Kit -  |
| 74LS22N            | 28   | LM340T-18              | 1.20 | CD4000           | 18    | CD4553           | 5.75 | MM5309         | 3.00  | 8223                 | 2.90         | Extender Board v                                       |
| 74LS28N            | 41   | LM340T-24              | 1.20 | CD4001           | 22    | CD4566           | 2.25 | MM5311         | 3.60  | IC Test Clips        |              | Video Interface b                                      |
| 74LS30N            | 28   | LM343H                 | 4.50 | CD4002           | 22    | CD4583           | 4.50 | MM5312         | 4.80  | to rear Clips        | 10           | 16K EPROM boar   |
| 74LS33N            | .39  | LM370                  | 1.15 | CD4002           | 1.19  | CD4585           | 1.15 | MM5313         | 3.60  | Red or Black .59     | .50          | 16K Static RAM   |
| - ALDOUR           | 100  | 2.0021.0               | 1.10 |                  |       | JUN-1003         | 1.10 |                | 0.00  | Dieck                |              |  |
|                    |      |                        |      |                  |       |                  |      |                |       |                      |              |  |

2.5 MHz Frequency Counter Kit As low as 10 Hz .6-.50" digits with PC

Not a Cheap Clock Kit \$17.45 full instructions

Includes everything except case. 2-PC boards. 6-.50" LED Displays. 5314 clock chip, transformer, all components and full instructions. Same clock kit with .80"

Digital Thermometer \$65.00

General purpose or medical 32°-230°F

Disposable probe cover ±.2° accuracy

Completely assembled w/compact case.

# **Digital Temperature Meter Kit**

Indoor and outdoor. Automatically switches back and forth. Beautiful. 50" LED readouts. Nothing like it available. Needs no additional parts for complete, full operation. Will measure -100° to +200°F, air or liquid. Very accurate. Complete instructions. \$39.95

# Clock Calendar Kit \$29.95

CT7015 direct drive chip displays date and time on .6" LEDS with AM-PM indicator. Alarm/doze feature includes buzzer. Complete with all parts, power supply and instructions, less case

### 1977 IC Update Master

Manual Complete integrated circuit data selector from all manufacturers 1,234 page master reference guide to the latest IC's including microprocessors and consumer circuits. 17,000 cross references for easier sourcing of hard to get parts. **Special pricing: \$24.95**, with free update service thru 1977. Domestic postage \$2.00. Foreign \$6.00.

### board and full instructions. \$40.00

30 MHz Frequency Counter Kit Same basic CMOS counter as above plus level controls and dual FET inputs. Prescalable to 200 MHz with PC board and

# **Function Module Card Kit**

Fully wired and tested.

Converts any frequency counter into 3½ digit DVM, digital thermometer, pulse & square generator from 10 Hz to 100 kHz. Complete kit minus power supply. \$25.00

## Stopwatch Kit \$26.95

Full six digit battery operated. 2–5 volts. 3.2768 MHz crystal accuracy. Times to 59 minutes, 59 seconds, 99 1/100 sec. Times standard, split and Taylor. 7205 chip, all components minus case. Full instructions. White or black plexiglass \$5.00

# Volt/ohm Probe

Batt. oper. AC/DC to 125 V. 2 pos. volt. and 2 neg. volt. plus continuity. Stainless steel, pocket size. comp. assem. \$34.95

60 Hz Crystal Time Base
Kit \$4.75 Converts digital clocks
from AC line frequency to crystal time
base. Outstanding accuracy. Kit includes:
PC board, MM5369, crystal, resistors,
capacities, and trimmer. capacitors and trimmer

TERMS: \$5.00 min. order U.S. Funds. Calif residents add 6% tax. BankAmericard and Master Charge accepted. Shipping charges will be added.

# Home Alarm Kit \$18.75

Designed for use with electronic siren module. AC power, battery backup, entry/ exit delay. Instant alarm for night use. NO/NC circuits. Test and arm indicators. 2 amp switching capability. All parts with complete instructions minus power supply. Electronic siren module kit. \$2.75

4 digit
DVM/clock 1.0" liquid XTAL

4 digit TV GAME CHIPS MM57100 6 Games Chip MM53104 Clock Driver LM1889 Modulator GI AY38500-1

# Variable Power Supply Kit

0-12 VDC @1/2A bench supply. Less than .1% line, load regulation. Remote sense capability. Constant voltage/circuit limit. Can be modified for other V/I ranges. Complete with board and transformers. Same supply at 1 amp

Cosmac 'ELF' Kit RCA CMOS Expandable Microcomputer. New PC board with monitor on PROM included. No hard wiring required. All on board including power supply. Complete kit of parts with new assembly manual. \$109.00 Includes audio amplifier & speaker. All in stock, immediate delivery Board only

Special case with front panel

\$15.00

## Auto Clock Kit \$15.95

tional MA1012 module with alarm option. Crystal time base PC boards and full instructions. Add \$3.95 for a beautiful dark gray case ready to install. This is the best value available anywhere!

FREE: Send for your copy of our 1977 QUEST CATALOG. Include 13¢ stamp.

SOFTWARE EDITORIAL

|      |         | UITERWYK AND BY PERMISSION & COURTESY OF SOUTHWEST TECHNICAL PRODUCTS CORP. SWHPC 6800 COMPUTER NEWSLETTER #1, JUNE 1976.  |   |           |   |  |
|------|---------|--|---|-----------|---|--|
| 6800 | MEMTEST | A BETTER 6800 MEMORY TEST<br>BY ED KEITH- INTERFACE AGE,<br>APRIL 1977, VOL.2,#5.  | 60-PTAL<br>60-PTSL<br>60-PTOD<br>60-TEXT<br>60-HCAL<br>60-HCAL<br>60-HCSL<br>60-HCSL<br>60-PACK | < < < < < | 0 | 8.00+0.48+2.00<br>8.00+6.48+2.00<br>3.00+0.18+1.00<br>2.00+0.12+1.00<br>INC.WITH PTAL<br>2.00+0.12+1.00<br>INC. WITH PTSL<br>2.00+0.12+1.00    |
| 8080 | AMLIFE  | JOHN CONWAY'S GAME OF LIFE<br>PROGRAMMED BY ALAN R. MILLER   | 61-PTAL<br>61-PTSL<br>61-PTOD<br>61-TEXT<br>61-HCAL<br>61-HCAL<br>61-HCSL<br>61-HCSL<br>61-PACK | < < < < < | 4 | 15.00+0.90+2.00<br>10.00+0.60+2.00<br>5.00+0.30+1.00<br>2.00+0.12+1.00<br>INC. WITH PTAL<br>2.00+0.12+1.00<br>INC. WITH PTSL<br>2.00+0.12+1.00 |
| 8080 | SFSL    | STAR LANES PROGRAM BY<br>STEVEN FABER -  | 62-PTBL<br>62-HCBL<br>62-TEXT<br>62-HCBL<br>62-HCBL<br>62-PACK                                  | < < <     | Ø | 15.00+0.60+2.00<br>2.00+0.12+1.00<br>2.00+0.12+1.00<br>INC. WITH PTBL<br>2.00+0.12+1.00  |
| 6800 | HDSS    | SHOOTING STARS TBX PROGRAM<br>BY HERMAN DEMONSTOY -  | 63-PTBL<br>63-HCBL<br>63-TEXT   | <         |   | 10.00+0.60+2.00<br>2.00+0.12+1.00<br>2.00+0.12+1.00  |
| 8080 | PAYROLL | PAYROLL PROGRAM IN BASIC<br>BY BUD SHAMBURGER -<br>INTERFACE AGE, JUNE 1977,<br>VOL.2,#7.  | 64-PTBL<br>64-HCBL<br>64-TEXT<br>64-PACK  | <<br><    | Ø | 20.00+1.20+2.00<br>5.00+0.30+2.00<br>2.00+0.12+1.00  |
| 8080 | TCOS    | DAM'S TAPE CASSETTE SOFTWARE OPERATING SYSTEM FOR THE ABBA MICKOCOMPUTER -SUMMARY BY R.A. STEVENS - INCLUDES BOBO ASSEMBLER + LINE TEXT EDITOR + MONITOR - TAPE FORMAT IS DON TARBELL'S OR PROCESSOR TECHNOLOGY'S CUTS STANDARD. INTERFACE AGE, JULY 1977, VOL.2.#%. |   | v v       |   | 30.00+1.80+2.00<br>5.00+0.30+1.00  |
| 8080 | PTOS    | DAM'S PAPER TAPE SOFTWARE OPERATING SYSTEM FOR THF 8080 MICROCOMPUTER-SUMMARY BY R.A. STEVENS -SAME AS TCOS #65-CTXX BUT FOR ASK 33 TTY I/O SYSTEM- INTERFACE AGE, JULY 1977, VOL.2.#8.  | 66-PTOD<br>66-MAN   | < <       |   | 30.00+1.80+2.00<br>5.00+0.30+1.00  |



**CIRCLE INQUIRY NO. 82** 

| 6800  | EVKMB    | SWTP'S 6800 MICROBASIC<br>VER. 1.4 MODIFIED FOR AMI'S<br>6800 EVK MICROCOMPUTER<br>BOARDS BY STEVEN D. WALL.  | 52-PTOD Ø   | 15.00+0.90+2.00  |
|-------|----------|---|---|--|
| 8080  | CCOKEN   | ARTIFICAL INTELLIGENCE<br>TIC-TAC-TOE PROGRAM<br>(OR MENACE OF THE<br>MICROWORLD) BY KEN BERKUM<br>-INTERFACE AGE, MARCH 1977,<br>VOL. 2, 4.  | 53-PTBL < 0<br>53-TEXT <<br>53-HCBL <<br>53-HCBL<br>53-PACK +                         | 10.00+0.60+2.00<br>2.00+0.12+1.00<br>INC. WITH PTBL<br>2.00+0.12+1.00  |
| 6800  | 4WTODHL  | DAY OF THE WEEK PROGRAM BY<br>JIM HUFFMAN-  | 54-PTBL < 0<br>54-TEXT <<br>54-HCBL <<br>54-HCBL<br>54-PACK 1                         | 6.00+0.36+1.00<br>1.00+0.06+1.00<br>INC. WITH PTBL<br>1.00+0.06+1.00   |
| 6800  | ЈНСВВР   | CHECKBOOK BALANCER PROGRAM<br>BY JIM HUFFMAN -  | 55-PTBL < 0<br>55-TEXT <<br>55-HCBL <<br>55-HCBL<br>55-PACK †                         | 6.00+0.36+1.00<br>1.00+0.06+1.00<br>INC- WITH PTBL<br>1.00+0.06+1.00   |
| 8080  | HEXDUMP  | INTEL HEX FORMAT PAPER TAPE<br>DUMP PROGRAM BY ALAN R.<br>MILLER - INTERFACE AGE,<br>APRIL 1977, VOL.2,#5.  | 56-PTAL < 1<br>56-PTSL <<br>56-PTOD <<br>56-HCAL <<br>56-HCAL<br>56-HCSL <<br>56-HCSL | 8.00+0.48+2.00<br>8.00+0.48+2.00<br>5.00+0.30+1.00<br>INC. WITH PTAL<br>2.00+0.12+1.00<br>INC. WITH PTSL<br>2.00+0.12+1.00 |
| 8080  | CONVERTI | NUMBER BASE CONVERSION-<br>NON DISC VERSION BY JOHN<br>W. SMAIN- INTERFACE AGE,<br>APRIL 1977, VOL.2,#5.  | 56-PACK +<br>57-PTBL < 0<br>57-TEXT <<br>57-HCBL <<br>57-HCBL<br>57-PACK +            | 7.00+0.42+1.00<br>2.00+0.12+1.00<br>INC. WITH PTBL<br>1.00+0.06+1.00   |
| 8080  | CONVERTS | NUMBER BASE CONVERSION-<br>DISC BASED VERSION OF<br>CONVERTI ABOVE BY JOHN<br>W. SWAIN - INTERFACE AGE,<br>APRIL 1977, VOL. 2. #5.  | 58-PTBL < 0<br>58-TEXT <<br>58-HCBL <<br>58-HCBL<br>58-PACK +                         | 7.00+0.42+1.00<br>2.00+0.12+1.00<br>INC. WITH PTBL<br>1.00+0.06+1.00   |
| Z8Ø   | SERIAL   | USER TTY HANDLER FOR THE<br>Z80 DELEVOPMENT SYSTEM BY<br>RICHARD E. MALY - INTERFACE<br>AGE, APRIL 1977, VOL.2,#5.  | 59-TEXT 0<br>59-HCAL<br>59-PTOD <<br>59-PTAL <<br>59-PTSL <<br>59-PACK 1              | 3.00+0.18+1.00<br>2.00+0.12+1.00<br>10.00+0.60+2.00<br>INC. WITH PTOD<br>INC. WITH PTOD                                    |
| 8080  | DOSE     | D&M'S DISC SOFTWARE OPERATING SYSTEM EXTENSION FOR THE NORTH STAR 8080 FLOPPY DISC OPERATING SYSTEM - SUMMARY BY R.A. STEVENS - ADDS TCOS/PTOS FUNCTIONS TO PROVIDE FULL OPERATING SYSTEM CAPABILITIES TO THE LIMITED NORTH STAR FLOPPY DISC SOFTWARE OPERATIN SYSTEM. PROGRAM MEDIA IS A NORTH STAR FLOPPY DISC INTERFACE AGE, JULY 1977, VOL.2.2.82 | 67-FDOD < 0<br>67-MAN <   | 60.00+3.60+3.00<br>5.00+0.30+1.00  |
| SC/MP | SSEIKOPP | SC/MP SEIKO PRINTER<br>INTERFACE AND PROGRAM BY<br>PHILIP ROYBAL - INTERFACE<br>AGE, MAY 1977, VOL.2,#6.  | 68-PTSL < 0<br>68-PTOD <<br>68-HCSL <<br>68-HCOD <<br>68-TEXT <<br>68-PACK *          | 15.00+0.90+2.00  |
| 280   | RASST    | Z80 SUPER STAR TREK MODIFIED<br>BY ROGER AMIDON. RUNS ON<br>TDL'S Z80 BK BASIC  | 69-PTBL < Ø<br>69-HCBL <<br>69-PACK †   | 10.00+0.60+2.00  |
| 8080  | DODR     | DIABLO OUTPUT DRIVER ROUTINE BY CHRIS TARRY - INTERFACE AGE, JULY 1977, VOL.2.#8.   | 70-PTOD < 0<br>70-PTSL <<br>70-PTAL <<br>70-TEXT <<br>70-PACK +                       | 15.00+0.90+2.00  |
| 6844  | IOTST    | 6800 PIA I/O TEST PROGRAM BY WILLIAM C. WRARY OF MOTOROLA & PERMISSION AND COURTESY OF MOTOROLA'S 6800 USER GROUP LIBRARY - INTERFACE AGE, JULY 1977, VOL.2,#R.   | 71-PTOD < 0<br>71-PTSL <<br>71-TEXT <<br>71-HCOD <<br>71-HCSL <<br>71-PACK +          | 7.00+0.42+1.50<br>10.00+0.60+2.00<br>INC. WITH PTSL<br>2.00+0.12+1.00<br>3.00+0.18+1.00                                    |
| нави  | TICTAC   | TIC TAC TOE GAME IN BASIC<br>BY BUD SHAMBURGER -  | 72-PTBL   | 7.00+0.42+2.00   |
| 80 80 | BOWL     | BOWL GAME IN BASIC BY BUD<br>SHAMBURGER - INTERFACE AGE,<br>JULY 1977, VOL.2,#8.  | 73-PTBL   | 7.00+0.42+2.00   |
| 6800  | BILOAD   |   | 74-PTSL < 0<br>74-HCSL <<br>74-HCSL<br>74-TEXT <<br>74-PACK †                         | 8.00+0.48+1.00<br>INC. WITH PTSL<br>2.00+0.12+1.00<br>1.00+0.06+1.00   |
| 6800  | BIPUNCH  | HIGH DENSITY BINARY TAPE<br>PUNCH BY PERMISSION AND<br>COURTESY OF MOTOROLA'S<br>M6800 USER GROUP LIBRARY-<br>INTERFACE AGE, AUG. 1977,<br>VOL.2,99.  | 75-PTSL < 0<br>75-HCSL <<br>75-HCSL<br>75-TEXT <<br>75-PACK †                         | 8.00+0.48+1.00<br>INC. WITH PTSL<br>2.00+0.12+1.00<br>1.00+0.06+1.00   |
|       | LMT      | LOCAL MEAN TIME BY JAMES<br>J. BRENNAN - INTERFACE AGE,<br>AUG. 1977, VOL.2#9.  | 76-PTBL < 0<br>76-HCBL <<br>76-TEXT <<br>76-PACK +                                    | 3.00+0.18+1.00<br>INC. WITH PTBL<br>1.00+0.06+1.00   |
|       | ASTRON   | LOCAL SIDEREAL TIME & DATE<br>BY JAMES J. BRENNAN -<br>INTERFACE AGE, AUG. 1977,<br>VOL.2,#9.   |   | 10.00+0.60+1.00<br>INC. WITH PTBL<br>2.00+0.12+1.00<br>2.00+0.12+1.00  |

| DIODES/ZENE  | RS   | SOCKETS/BR   | IDGES   | TRANSISTORS, LEDS, etc.   |   |  |  |  |  |
|--|--|--|---|---|---|--|--|--|--|
| 1N4004 400v<br>1N4005 600v<br>1N4007 1000v<br>1N4148 75v 10<br>1N753A 6.2v<br>1N758A 10v<br>1N759A 12v<br>1N4733 5.1v<br>1N5243 13v<br>1N5244B 14v   | 1A .08 1 1A .08 1 1A .08 1 1A .15 1 mA .03 2 z .25 2 | 3-pin pcb .25<br>4-pin pcb .25<br>3-pin pcb .25<br>3-pin pcb .25<br>2-pin pcb .45<br>4-pin pcb .35<br>3-pin pcb .35<br>3-pin pcb .35<br>0-pin pcb .50<br>olex pins .01 To-<br>Amp Bridge 100-<br>5 Amp Bridge 200- |   | LED Green, Red, Clea  | .10<br>.35<br>A 60v .50<br>rlington .35<br>ir .15<br>high com-anode 1.95<br>-anode 1.50 |  |  |  |  |
| C MOS  | •  |  |   | L –   |   |  |  |  |  |
| 4000         .15         7400           4001         .20         7401           4002         .20         7402           4004         3.95         7403           4006         1.20         7406           4008         1.20         7406           4009         .30         7407           4010         .45         7408           4011         .20         7409           4012         .20         7410           4013         .40         7411           4014         1.10         7412           4015         .95         7413           4016         .35         7414           4017         1.10         7416           4018         1.10         7417           4019         .70         7420           4020         .85         7426           4021         1.35         7427           4022         .95         7430           4023         .25         7432           4024         .75         7437           4025         .35         7444           4027         .50         7441 | .15  | .35  | 1176 1.25<br>1180 .85<br>1181 2.75<br>1182 .95<br>1190 1.75<br>1191 1.35<br>1192 1.65<br>1193 .85<br>1194 1.25<br>1195 .95<br>1196 1.25<br>1197 1.25<br>1198 2.35<br>1221 1.00<br>1367 .85<br>1221 1.00<br>1367 .85<br>1400 .25<br>1401 .25<br>1401 .25<br>1401 .25<br>1401 .25<br>1401 .25<br>1401 .25<br>1401 .25<br>1402 .30<br>1403 .35<br>1404 .25<br>1405 .25<br>1406 .25<br>1407 .25<br>1408 .35<br>1409 .25<br>1400 .25 | 74H72 .55 74H101 .75 74H103 .75 74H106 .95  74L00 .35 74L02 .35 74L03 .30 74L04 .35 74L10 .35 74L20 .35 74L30 .45 74L47 1.95 74L51 .45 74L72 .45 74L73 .40 74L74 .45 74L73 .55 74L93 .55 74L123 .55  74S00 .55 74S02 .55 74S03 .40 74S04 .35 74S04 .35 74S05 .35 74S08 .35 74S08 .35 74S08 .35 74S08 .35 74S08 .35 74S08 .35 74S09 .25 74S09 .25 74S09 .25 74S09 .25 74S09 .25 74S09 .25 74S01 .35 74S11 .35 74S11 .35 74S40 .25 74S50 .25 74S50 .25 74S64 .25 74S74 .40 74S112 .90 74S114 1.30 | 74\$133   |  |  |  |  |
| 9000 SERIES  | 9266   |  | EARS, REGUL   |   | 5   I M 723   50  |  |  |  |  |
| 9301 .85<br>9309 .35<br>9322 .85<br>95H03 .55<br>9601 .75<br>9602 .50  | 8266<br>8836<br>MCT2<br>8038<br>LM201<br>LM301<br>LM308 (Mini)   | .35 LM3201<br>.95 LM3201<br>.95 LM3202<br>.95 LM3203<br>.75 LM339<br>.25 7805 (3<br>.75 LM3403   | T12 1.25<br>T15 1.65<br>.95<br>40T-5) .95   | LM340T-24 .95<br>LM340K-12 2.15<br>LM340K-15 1.25<br>LM340K-18 1.25<br>LM340K-24 .95<br>LM373 2.95<br>LM380 .95   | 5 LM725 1.75<br>5 LM739 1.50<br>5 LM741 8-14 .20<br>6 LM747 1.10<br>6 LM1307 1.25       |  |  |  |  |
| MEMORY CLOCKS 74S188 (8223) 3.00 1702A 7.95 MM5314 3.00  | LM309H<br>LM309K(340K-5  | .65 LM340°<br>.85 LM340°   | T-15 1.00   | LM709(8,14 PIN) .25<br>LM711 .45  |   |  |  |  |  |
| MM5316 3.50<br>2102-1 1.75<br>2102L-1 1.95<br>TMS6011NC 6.95<br>8080AD 15.00<br>8T13 1.50<br>8T23 1.50<br>8T24 2.00<br>2107B-4 4.95  | INLIMITED 111 (714) 278-439 nimum orders accepted ties Tax Charge / BankAmericard                            | NE567 1.35   |   |   |   |  |  |  |  |

# FORTRAN/BASIC

by Wm. C. Thompson III

A microcomputer, despite its size and cost, is capable of much more than most users realize at purchase time. Through experience, it is soon found that with careful programming and sacrifices in speed of execution, major programs which the user has developed or run on larger machines may be adapted to run on the microcomputer (or mini) even without a full complement of floppy disc drives and 64k memory.

The program run time may suffer considerably, but because of the ready access of the microcomputer, the user can have the results hours or days ahead of batch or time-share solutions on large computers. If the program runs are fast enough, or the program is run very infrequently, the microcomputer can entirely replace use of the costly batch or time-share machines. With this in mind, I offer the following tips and outline for conversion of programs from FORTRAN to BASIC. These tips have accumulated from many program conversions from FORTRAN to Hewlett-Packard BASIC but are applicable to virtually any FORTRAN/BASIC conversions with only minor changes.

As an example I shall use the conversion of a Load Flow Circuit Analysis Program run in FORTRAN on a Xerox Sigma 3 computer and an IBM 360 to run in BASIC on a Hewlett-Packard 9830A programmable calculator.

1. First examine the dimension statements in the program and determine the amount of memory necessary to dimension fully the arrays. At this point you must also note what precision most of the variables have. Fortran, and some versions of BASIC allow integer, single and double precision. Single precision on most machines is 6 or 7 significant digits, double precision 12 or more.

10 DIM AS[25],BS[25],CS[25,4],DS[25,4],ES[25],FS[25],GS[25],HS[25,7]
20 DIM 11(25,2],JS[25],KS[25],LS[25],MS[25],NS[25],OS[25],PS[25],OS[25]
30 DIM RS[25],SS[25],TS[25],US[25,9],VI[25,2],WS[100],XS[25],YS[25]
40 DIM ZS[25],AS[25],BS[40],CS[240]

a. BASIC program DIMENSION statements. I and S after an array name indicate integer and split precision. § indicates a string variable.

DIMENSION P(100),0(100),GS(100),BS(100),EMR(100),JSTR(100),EMB(100), ER(100),EI(100),PLOD(100),OLOD(100),0MAX(100),OMIN(100),PDEL(100), ODEL(100),ZLR(100),ZLI(100),ZKLR(100),ZKLI(100),GSEN(100), DIMENSION G(100),B(100),NFTO(100),RATO(100),RATG(100),B2(100), QQQ(100)

DIMENSION NAM(5), ITIL(40), LNA ((100,5), NNAW(100,5), CLIN(10,7), LLIN(10,7), CBUS(10,9), LBUS(10,5), KBUS(200)

b. Fortran program DIMENSION statements.

Figure 1.

Some calculations will require double precision but single precision is adequate for most problems. If the fully dimensioned arrays take up more than one-half your available memory, then you should consider decreasing the array size if possible.

In Figure I is shown the dimension statement for the Load Flow Program. The arrays were dimensioned at only one-fourth their original size.

This limited the size of circuit which could be run to 25 lines and 25 busses but a little checking up had shown that anyway 95% of the cases run were less than 20 busses and 20 lines. If you must have large arrays you may have to break the program into very small segments. Since the HP9830 only allows 26 array names (A to Z), several of the arrays were dimensioned as 25X4 matrices. In these each 25X1 array was used as a separate matrix.

For example, the matrix ZLI (100) in the Fortran source corresponds to C(n,3) in the BASIC version while ZKLI (100) corresponds to C(n,4) in BASIC.

Some of the arrays which were dimensioned were Alphanumeric (A-format). You will have to go through the program to pick these out. They may be handled by using strings (as in the sample) or sometimes may be entirely replaced by print statements (for titles and other functions).

Now we have determined that we will have sufficient space for the variables, let's attack the program head on.

- 2. The program structure was now examined and it was found that the program naturally broke into five segments. Iterative processes and loops that must cycle repeatedly were retained completely within a segment so that repeated loading of tape files a slow process at best was avoided. If disc files are available such repeated loads may be tolerable, but are still ideally avoided.
- 3. With this structure in mind, conversion on a line-toline basis was begun. Here the question of what to do with the variable names arises. That is, most Basics only allow one letter and one number (such as A1) for variable names so what do you do with RATG or QMAX? The first answer which comes to mind is to abbreviate RATG: "R" (or R1 if R is already used). With some quick thinking you realize that there are undoubtedly going to be at least 12 variables that start with R or some letter so that scheme falls apart. Here is where I decided to adopt a different means of shortening variables. I made two columns on a sheet of paper and wrote down the variables from the fortran program, as I came to them, in one column and assigned consecutive Basic variables to the other column (consecutive BASIC variables: A;, A1, A2 . . . A9, B0 . . . Z9) The only exception to this scheme was to keep the index variables such as I, J, K, M which were used and reused repeatedly. Variables such as A1, A0 in the Fortran program did not retain the same names and ended up with such designa-

# CONVERSIONS

tions as M9, P0. Any attempt to maintain the same names at this point seems to lead into a confusing and tangled mess. Note that some Fortran programs I have converted have contained both A1 and AONE.

Since my first program I have found ways to speed up greatly this step by using string substitution utility routines available on time sharing and on micro's and

mini's via text editing provisions.

Thus using the program as text, you can substitute A7 for QVAR everywhere it occurs in the program with one command (sheer ecstasy!). Beware though of possible problems with substrings. For example, if you also have a variable TQVAR you might end up with TA7. This need not become a problem if you just remember to substitute B3 for TA7 instead of TQVAR.

This is also the time to change other easily replaceable nomenclature such as " < " for ".LT.", " <= " for ".LE.", etc. You could even substitute "FOR" for "DO" and "NEXT" for "CONTINUE" if the Fortran loops seem to warrant it. The FOR-NEXT loops will require more than just this substitution though so you may want to make all the modifications at once.

Setting up the variable conversion table is much easier if you have a variable list from a run of the program. Most Fortran compilers will print some type of variable list or map if requested.

4. In a similar manner, a two column table of line number references will be very valuable in establishing

proper program flow.

5. Fortran "IF" statements are replaced by BASIC "IF" or computed "GOTO" statements. For example, the Fortran statement:

IF(C\*A\*\*B) 500,600,700 might be replaced by:

GOTO (SGN(C\*A+B) + 2)500,600,700

(in some BASICS: ON(SGN(C\*A+B) + 2) GOTO 500,600, 700)

also possible is:

 $Q = C^*A + B$ 

GOTO 1\*(Q < 0) + 2\*(Q = 0) + 3\*(Q > 0) of 500,600,700 and if you have many IF statements:

DEFFNI(X) = SGN(X) + 2

GOTO FNI(C\*A+B) of 500,600,700

Remember, that if the Fortran statement is similar to this.

IF X 500,500,510

510 X = X + 1

the BASIC statement of this form will normally execute much faster than the above forms:

IF X < = 0 THEN 500

510 X = X + 1

Execution is faster since most compilers/interpreters will treat a computed GOTO as a nest or series of comparisons, while the simple IF statement requires only one comparison.

6. "FORMAT" (and accompanying READ/WRITE statements) normally will take special considerations. Even if your version of BASIC incorporates FORMAT and WRITE statements similar to Fortran the probability is high that you will want to convert from a 132 character width to a 80 character or 72 character width. And, most BASIC compiler/interpreters allow either PRINT statements or perhaps, PRINT with USING statements. With all the complications that formatting produces, I have found it best to simply enter a statement like:

PRINT "FORT. STATEMENT #125";A;A1;B;BL;B2
Then when you test the program you will have the values
of the variables along with a reference to the Fortran
program to aid in verifying proper program execution.
Once the program has been debugged you may then
experiment with establishing a format for the output,
using actual values for the variables.

7. In Fortran programs you will come across statements using H and A formats. Some of these, in WRITE/FORMAT pairs are easily handled, since they simply print a heading or title. Others may actually input, compare and manipulate data. If you have string capabilities in your BASIC, these are usually easily handled, though deciphering the Fortran execution may be complicated. If you do not have string capabilities, you will probably have to change the type of data handled, resorting to some types of numeric coding schemes.

8. At last you're finished with your conversions, except, the results you get just don't agree with those from the original. At this point, before you tear your hair out and resign yourself to a six week step by step debugging run through the program, try this: — Take your Fortran program to your nearest computer which can run it and run a sample set of data through the program. Now, compare these results with your BASIC version on the same data. From my experience at least half the Fortran programs I have converted in which I was furnished sample data and output, did not include the output from the furnished data, including some in which a manual had been prepared which included a sample run of the program.

Now with respect to your results, do not expect exact agreement. The way that numbers, calculations and functions are handled varies enormously between different machines and may result in a build-up of accumulated "errors" — "residuals" may be a better word. The results however, should not be significantly different, so if they vary greatly, closer study is certainly necessary.

**INTERFACE AGE 161** 

# **MOTOROLA EXORCISER &** MEK D1 & MEK D2 COMPATIBLE MODULES

MEK6800D2 - 6800 KIT ONLY \$235.00

9601 16 Slot Mother Bd. \$175.00 9602 16 Slot Card Cage 72.00 9610 Proto Board 37.00 9615 4K EPROM Module (17024) 350.00 9615 K4 KEPROM Kit Module 275.00 9620 16 Port Parallel I/O 375.00 9626 8K Static RAM Module 35.00

9626K 8K Static RAM Kit 275.00 9650 8 Port Duplex Asyn Serial I/O 395.00 All assembled & tested not Kits

PLUS MOTOROLA TV MONITORS — PRIME Model M3000-100 12" display Model M2000-155 9" display Add \$10.00 for shipping

|   | V              | IC MARK                    | FT PI        | ACE V                    | 2,100                      | The state of the s | 9626 8K Sta           | atic RA      | M Module 350                               | .00   | o tot stilp    | Pilig   |                         |
|---|----------------|----------------------------|--------------|--------------------------|----------------------------|--|-----------------------|--------------|--|---|----------------|---|-------------------------|
|   |                | IO MAIN                    |              | 701                      |                            | OD 4027 52   | 74C154                | 2.75         | LM3909 1.10                                | SL1623C   | 2.95           | EXAR  | 9                       |
| MICROPROCESSORS                                 | PROM'S         |                            |              | proposed and the         |                            | CD4027 .59<br>CD4028 1.50  | 74C160                | 1.40         | LM7520 2.25                                | SL1626C   | 2.95           | XR2556CP  | \$2.95                  |
| 8080A \$ 16.95                                  | 6330 \$        | 2.95 7482N                 | .99          | 74200 5.95               | LS378 1.29                 | CD4029 1.70  | 74C161                | 2.10         | LM7524N 1.75                               | SL1630C   | 1.95           | XR2240CP  | 4.20                    |
| 8008-1 16.95<br>8212 4.25                       | 6331           | 2.95 7483N<br>3.50 7485N   | .70<br>.97   | 74251 1.69<br>74279 1.10 | 81LS95 1.10<br>81LS96 1.10 | CD4030 .42   | 74C174                | 2.10         | LM7525N 1.90                               | SL1640C   | 1.95           | XR320P  | 1.40                    |
| 8214 8.95                                       | 6301           | 3.50 7486N                 | .39          | 74298 1.99               | 81LS97 1.10                | CD4033 2.49<br>CD4034 4.95   | 74C192<br>74C193      | 2.39         | LM7534N 2.20<br>LM7535N 1.25               | SL 1641 C<br>SL 1652C                           | 5.95<br>7.50   | XR 2208CP<br>XR 2211CP                            | 4.75<br>5.95            |
| 8216 4.25                                       | 6340           | 18.95 7488N                | 3.95         | 7436579                  | 81LS98 1.10                | CD4034 4.95<br>CD4035 1.79   | 74C193                | 2.65         | 75324 3.50                                 | SL 1680C  | 5.95           | XR2567CP  | 1.80                    |
| 8224 4.95                                       |                | 18.95 7489N<br>9.95 7490N  | 2.25         | 74366 .79<br>74367 .79   | 74S & 74L                  | CD4040 1.05  | LINEAR                | 2.00         | SG4501T 2.40                               | SL560   | 9.95           | XR1310CP  | 3.00                    |
| 8226 4.95<br>8228 8.75                          | 6305-1         | 9.95 7490N<br>9.95 7491N   | .45          | 74368 .79                | 74500 .40                  | CD4041 1.95  | LM300H                | .80          | SG4501N 2.40                               | DIVIDERS  |                | XR 1800CP   | 3.00                    |
| 8251 14.95                                      |                | 18.95 7492N                | .45          | 74LS00 TTL               | 74S04 .42<br>74S08 .40     | CD4042 1.45<br>CD4043 1.45   | LM301H                | .45          | SG3524 8.95<br>RC4194T 6.95                | SP8600  | \$ 6.95        | XR2206CP<br>XR2206KA                              | 5.25                    |
| 9551 14.95                                      | 6353           | 18.95 7493N                | .45          | 74 LS00 .22              | 74S08 .49<br>74S10 .40     | CD4044 1.45  | LM301CN               | .45          | RC4195T 6.95                               | SP8601<br>SP8602                                | 16.00          | IC PCB,   |                         |
| 9555 14.95 X<br>6800P 24.50                     |                | 27.00 7494N<br>7.95 7495N  | .75          | LS02 .24                 | 74511 40                   | CD4047 1.95  | LM302H<br>LM304H      | 1.25         | RC1458CN .89                               | SP8602<br>SP8603                                | 14.50          | Inst.   | 18.95                   |
| 6810-1 4.95                                     | 1702A-6        | 4.49 7496N                 | .99          | LS04 .24                 | 74S20 .40<br>74S30 .40     | CD4049 .61<br>CD4050 .61   | LM305H                | 1.20         | RC1556CN .99<br>RC3403AD 2.30              | SP8604  | 8.25           | XR2206KB<br>Complete                              |                         |
| 6810 6.25                                       |                | 16.95 7497N                | 4.25         | LS05 .28                 | 74S30 .40<br>74S32 .78     | CD4050 .61<br>CD4051 1.25  | LM306H                | .95          | RC4131CN .99                               | SP8607  | 17.00          | Kit   | 29.95                   |
| 6820P 8.95                                      |                | 21.95 74100<br>16.95 74104 | .99          | LS08 .28<br>LS10 .28     | 74537 .85                  | CD4052 1.25  | LM307CN               | .45          | RC4136D 1.90                               | SP8613<br>SP8614                                | 17.50<br>18.00 | XR22G7CP  | 3.75                    |
| 6834-1 16.95<br>6834 21.95                      | 82816          | 16.95 74104<br>4.50 74105  | .69          | LS13 .79                 | 74\$38 .95                 | CD4059 1.95  | LM307H<br>LM308H      | 1.00         | RC4558CN .99                               | SP8615  | 20.00          | XR742CP   | 3.95<br>4.25            |
| 6834 21.95<br>6850 9.95                         | 8223           | 2.95 74107                 | .39          | LS14 1.69                | 74S40 .40<br>74S74 79      | CD4063 2.49<br>CD4068 .35  | LM308CN               | 1.00         | RC4151CN 6.50<br>LM358N 1.29               | SP8616  | 22.00          | XR4202CP<br>XR2265                                | 6.95                    |
| 6852 11.95                                      | 5203           | 6.95 74109                 | .49          | LS20 .26<br>LS27 .38     | 74S74 .79<br>74S138 1.69   | CD4069 .35   | LM309H                | 1.10         | SHIFT REGISTER                             | S SP8620<br>SP8621                              | 12.50          | SOCKETS   | 0.55                    |
| 6860 15.95                                      | 7400TTL        | .15 74121                  | .35          | LS27 .38<br>LS30 .26     | 745139 1.69                | CD4070 .35   | LM309K                | 1.25         | MM500 \$1.25                               | SP8621<br>SP8622                                | 8.50<br>6.50   | 14 Pin ww   | .37                     |
| 6871A 19.95<br>Prog. Man 15.00                  | 7400N<br>7401N | .19 74122                  | .65          | LS32 .34                 | 748151 1.49                | CD4071 .35   | LM310H<br>LM311H      | 1.15         | MM5013 2.95                                | SP8630  | 20.00          | 16 Pin ww   | .38                     |
| Hard Man 15.00                                  | 7402N          | .18 74125                  | .58          | LS40 .26                 | 74S158 1.49<br>74S174 1.59 | CD4072 .35<br>CD4073 .35   | LM311CN               | .59          | MM5016 , 4.95<br>MM5017 , 2.95             | SP8631  | 12.00          | 18 Pin ww   | .60                     |
| Tiny Basic P/T . 20.00                          | 7403N          | .19 74126                  | .58          | LS42 1.10<br>LS51 .26    | 745175 1.59                | CD4075 .35   | LM312H                | 1.95         | P2405 5.95                                 | CB Sythesizer Pa                                |                | 22 Pin ww<br>24 Pin ww                            | .89<br>.85              |
| Tiny Basic EPROM 125.00                         | 7404N          | .19 74132<br>.22 74136     | 1.05         | LS73 .56                 | 745189 2.95                | CD4078 .35   | LM318H                | 1.50         | N2518B 4.95                                | 8921  | \$12.95 Pair   | 40 Pin ww   | 1.25                    |
| 6831 MACRO 30.00                                | 7405N<br>7406N | .29 74141                  | 1.10         | LS74 .56                 | 74S201 3.95                | CD4081 .40   | LM318N<br>LM320K/     | 1.50         | N2533 4.95                                 | SP8632  | 10.00          | 8 Pin S/T   | .17                     |
| 2901 22.95<br>2902 3.95                         | 7407N          | .29 74142                  | 3.75         | LS75 .79                 | 74S251 1.69<br>74S257 1.69 | CD4082 .40<br>CD4094 2.49  | 340K-5, 8,            | )            | 3341 FIFO 6.95<br>3347 FIFO 6.95           | SP8634  | 35.00          | 14 Pin S/T  | .20                     |
| 2902 3.95<br>2905 9.95                          | 7408N          | .25 74143                  | 3.95         | LS76 .59<br>LS83 1.69    | 74L00 .39                  | CD40160  | 12, 15, 24            | 1.95         | 2841 FIFO 11.95                            | SP8635<br>SP8638                                | 27.50<br>22.50 | 16 Pin S/T<br>18 Pin S/T                          | .22                     |
| . 2906 11.95                                    | 7409N          | .25 74144<br>.18 74145     | 4.95<br>1.05 | LS85 1.99                | 74L04 .39                  | 40160 2.10   | LM320T/<br>340T-5, 8, |              | 2812 FIFO 11.95                            | SP8637  | 18.00          | 22 Pin S/T  | .35                     |
| 2907 10.75<br>2909 21.95                        | 7410N<br>7411N | .28 74147                  | 2.25         | LS86 .55                 | 74L10 .39                  | 40161 2.10<br>40174 2.10   | 12, 15, 24            | 1.45         | TM\$3002LR 3.95                            | SP8640  | 6.20           | 24 Pin S/T  | .41                     |
| 2909 21.95<br>2911 3.95                         | 7412N          | .39 74148                  | 1.79         | LS90 1.10<br>LS92 1.10   | 74L20 .39<br>74L30 .39     | 4508 3.95  | LM324N                | 1.65         | TM\$3132NC 2.95<br>1402 3.95               | SP8641<br>SP8642                                | 7.50<br>12.50  | 28 Pin S/T  | .49                     |
| 29720 7.95                                      | 7413N          | .45 74150<br>.69 74151     | .95<br>.75   | LS92 1.10<br>LS93 1.10   | 74L42 1.29                 | 4510 1.99  | LM339N                | 1.55         | 1403 3.95                                  | SP8642<br>SP8643                                | 20.00          | 40 Pin S/T  | .63                     |
| 29721 7.95                                      | 7414N<br>7416N | .35 74153                  | .90          | LS95 1.69                | 74L73 .89                  | 4511 1.99<br>4515 3.95   | LM370H<br>LM373N      | 1.65<br>3.95 | 1404 3.95                                  | SP8646  | 6.50           | CONNECTORS  | Mark and a second       |
| Z80 37.95                                       | 7417N          | .35 74154                  | 1.29         | LS107 .56                | 74L74 .89                  | 4516 1.99  | LM377N                | 4.50         | N2527 5.95                                 | SP8647  | 8.00           | \$100 BUS W/W IMSAI                               | \$5.00                  |
| Z80PIO 14.95                                    | 7420N          | .20 74155                  | .99          | LS109 .56<br>LS112 .56   | 74L85 1.49<br>74L86 1.49   | 4518 1.99  | LM380N                | 1.00         | DISPLAYS/LEDS<br>FND 357 (.375) \$1,2      | SP8650<br>SP8651                                | 25.00<br>18.50 | S100 BUS S/T IMSAI<br>S100 BUS W/W ALTAIR         | 5.00<br>5.50            |
| Z80CTC 14.95                                    | 7421N          | .33 74156<br>.47 74157     | .95<br>.95   | LS113 .56                | 74L90 1.29                 | 4520 2.49  | LM381N<br>LM384N      | 1.90         | FND 367 (.375) 1.3                         |   | 12.00          | S100 BUS S/T ALTAIR                               | 5.25                    |
| 6502 24.95                                      | 7422N<br>7423N | .37 74158                  | 1.79         | LS123 .99                | 74L95 1.29                 | 4522 2.56<br>4526 2.56   | LM555CN               | .59          | FND 500 (.500) 1.2                         | SP4020  | \$12.95        | RS232 25 Pin Male DB25P                           |                         |
| CP1600 49.95                                    | 7425N          | .39 74160                  | 1.20         | LS132 1.10               | 74L154 1.59<br>74L164 1.69 | 4527 2.69  | LM556CN               | 1.69         | FND 507 (.500) 1.0                         |   | 16.95<br>9.95  | PS232 25 Pin Female DB25                          |                         |
| RAM's   | 7426N          | .35 74161                  | .95          | LS136 .99<br>LS138 1.39  | 74L165 1.89                | 4528 1.50  | LM566CN               | 2.00         | FLV 110 Redled 5/1.0<br>FND 800 (.800) 2.5 |   | 16.95          | Plastic Hood<br>IMSAI Card Guides                 | .75<br>4/1.00           |
| ★21L02(450ns) 1.75<br>21L02(250ns) 2.25         | 7427N<br>7428N | .35 74162<br>.49 74163     | .95          | LS139 1.49               | 74L192 1.99                | 4531 1.99  | LM567CN<br>LM565CN    | 1.95         | FND 807 (.800) 2.5                         |   |                | NEW CTS DIPSWIT                                   |                         |
| 21L02(250ns) 2.25<br>2102(450ns) 1.69           | 7430N          | .22 74164                  | 1.05         | LS151 1.49               | 74L193 1.99                | 4532 2.69<br>4543 2.25   | LM565H                | 1.95         | TRANSISTORS                                | CRYSTALS  |                |   |                         |
| 2102(650ns) 1.59                                | 7432N          | .31 74165                  | 1.05         | LS153 1.29<br>LS155 1.49 | 4000 CMOS                  | 4555 1.79  | LM703CH               | 1.49         | 2N3904 5/\$1                               | 1 01411   | \$ 5.85        | CTS206-4<br>CTS206-5                              | \$1.75<br>\$1.75        |
| 2102(1 sec) 1.40                                | 7437N<br>7438N | .27 74166                  | 1.00         | LS155 1.49<br>LS157 1.29 | CD4000 .25                 | 4556 1.79  | LM709N                | .49          | 2N3906 5/\$1                               | 00 2.0MH <sub>3</sub>                           | 5.85           | CTS206-6  | \$1.75                  |
| 2111 3.95                                       | 7438N<br>7440N | .27 74170<br>.22 74172     | 2.49<br>8.49 | LS158 1.29               | CD4001 .25<br>CD4002 .25   | 4581 4.90<br>4582 1.99   | LM709CH<br>LM710N     | .49          | MPSA 13 4/\$1                              | 00 2.097152MH <sub>3</sub>                      | 5.85           | CTS207-7  | \$1.75                  |
| 21L11 4.25                                      | 7441N          | .85 74173                  | 1.49         | LS161 1.39               | CD4002 .25<br>CD4006 1.69  | 4585 2.49  | LM711N                | .49          | 2N2369 5/\$1                               |   | 5.85           | CTS208-8<br>CTS209-9                              | \$1.95                  |
| 2112 2.95                                       | 7442N<br>7443N | .59 74174<br>.75 74175     | 1.25         | LS162 1.39<br>LS163 1.39 | CD4007 .25                 | 4901 .49   | LM711CH               | .49          | 2N2221 5/\$1<br>2N3440 4/\$1               |   | 3.95<br>4.95   | CTS209-9  | \$1.95<br>\$1.95        |
| 2101 2.95                                       | 7443N<br>7444N | .75 74175<br>.75 74176     | .90          | LS164 1.39               | CD4008 1.69<br>CD4009 .55  | 4911 .49   | LM723N<br>LM723CH     | .55<br>.55   | 2N5139 5/\$1                               | 00 4.194304MH                                   | 5.95           |   | - 1100                  |
| 21L01 3.95<br>74C89 4.95                        | 7445N          | .75 74177                  | .90          | LS174 1.39               | CD4009 .55<br>CD4010 .55   | 74C00 .35<br>74C04 .35   | LM725CH               | 3.25         | 2N5134 5/\$1                               | 00 4.91520MH2                                   | 5.95           | EVK 99  | 4                       |
| 74\$189 2.95                                    | 7446N          | .79 74180                  | .89          | LS175 1.39               | CD4011 .25                 | 74C10 .35  | LM733N                | 1.00         | 2N3724A 4/\$1                              | 00 5.0MH <sub>3</sub>                           | 4.95           | (4) FMM   |                         |
| 7489 1.88                                       | 7447N<br>7448N | .65 74181<br>.75 74182     | 2.39         | LS190 2.49<br>LS191 2.49 | CD4012 .25                 | 74C20 .35  | LM733H<br>LM739N      | 1.29         | 2N3495 \$1.<br>2N3702 4/\$1                | 0.7 14311173                                    | 5.95           | (1) EVK consists of the following only            | \$133.00                |
| ★4116 16K 44.95                                 | 7450N          | .75 74182<br>.22 74184     | .95<br>2.10  | LS192 2.49               | CD4013 .55<br>CD4014 1.95  | 74C30 .35<br>74C42 1.95  | LM739N<br>LM741CH     | 1.29         | 2N2484 3/\$1                               |   | 4.95           | (2) EVK 99 Kit Fully expand                       | ed 449.95               |
| ↑ TMS4060 22 pin · · 4.25<br>★ 4096 16 pin 4.95 | 7451N          | .26 74185                  | 2.25         | LS193 2.49               | CD4014 1.95<br>CD4015 1.95 | 74C42 1.95<br>74C48 2.90   | LM741CN               | .39          | 2N3766 2/\$1                               | 89 12 21113                                     | 4.95           | (3) Universal Kluge Board                         | 95.00                   |
| 2107B-4 4.25                                    | 7453N<br>7454N | .26 74186                  | 14.50        | LS194 2.49<br>LS195 .52  | CD4016 .55                 | 74C73 .85  | LM747N                | .75          | 2N3692 5/\$1<br>2N3055 \$                  | 00  | 4.95           | (4) 16K Byte RAM Board<br>(5) 6 Slot Mother Board | 75.00<br>35.00          |
| MM5261 3.95                                     | 7459N          | .29 74190                  | 1.15         | LS251 1.39               | CD4017 .99                 | 74074 .85  | LM747H<br>LM748H      | .75<br>.39   | 2N3771 \$1.                                | 69 18.0MH <sub>3</sub>                          | 4.95           | (6) Extender Board                                | 45.00                   |
| MM5262 1.95<br>MM5280 4.95                      | 7460N          | .29 74191                  | 1.15         | LS253 1.49               | CD4018 2.39<br>CD4019 .55  | 74C76 1.39<br>74C85 1.25   | LM748N                | .39          | 2N3772 \$1.                                | 69 18.432MH <sub>3</sub>                        | 5.95           | (7) Video Board/Disk                              | 95.00                   |
| MM5280 4.95<br>8599 1.88                        | 7470N          | .44 74193                  | .99          | LS257 1.29               | CD4020 1.39                | 74C86 1.79   | LM1414N               | 1.75         | SPT410/DTS410 . \$ .                       |   | 4.95           | Connectors<br>Solid Chassis                       | \$ 6.50 ea.<br>\$120.00 |
| P3101 2.95                                      | 7472N<br>7473N | .36 74194                  | 1.39         | LS258 1.29<br>LS279 1.10 | CD4021 1.85                | 74C89 4.95   | LM1458CN              | .65          | PLESSEY                                    | 22.1184MH <sub>3</sub><br>27.000MH <sub>3</sub> | 5.95<br>5.95   | Frame Chassis                                     | \$ 69.95                |
| 5101C-E 9.95                                    | 7474N          | .31 74195                  | .75<br>1.19  | LS283 1.10               | CD4022 1.20<br>CD4023 .29  | 74C90 1.25<br>74C93 1.35   | LM1496N<br>LM2111N    | .95<br>1.95  | SL1610C \$ 1.1<br>SL1611C 1.1              | 20 00011113                                     | 5.95           | PCB Ejectors                                      | 6 for \$3.00            |
| 3107 3.95<br>1101 1.95                          | 7475N          | .40 74107                  | 1.19         | LS367 .99                | CD4023 .29<br>CD4024 1.25  | 74C95 1.35   | LM2901N               | 1.95         | SL1611C 1.1<br>SL1612C 1.1                 |   | 5.95           | Plus now available AMI MAD 16                     |                         |
| 1103 1.95                                       | 7476N<br>7479N | 4 70 74198                 | 1.69         | LS368 .99<br>LS377 1.29  | CD4025 .29                 | 74C106 1.49  | LM3065N               | .69          | SL1613 1.                                  |   | 12.95          | Macro Assem Chip on ROM                           | \$30.00                 |
| 4008-L 2.95                                     | 7480N          | .59 74199                  | 1.69         | 1.29                     | CD4026 1.95                | 74C107 1.10  | LM3900N               | .55          | SL1621C 2.                                 | 95  |                | Coming soon AMI 8K Basic                          | 101                     |

LOGO'S I THE BEST 8K RAM KIT



The last word in 8K Ram Boards. Special Price of only \$219.95
Features:

Lowpower 21L02, 450ns, Dip Switch Selectable addressing down to 256 Byte blocks, No wait states, fully buf-

fered, battery back-up.

Plus the first 32K Static Memory Board Uses 2114 4K RAMS 16K . . . \$ 579.95 24K . 879.00

(Note, supply contingent on 2114 availability. Allow 30 days.)

| DA    | TA B        | 00   | K    | S     |      |      |     |     |     |    |       |         |
|-------|-------------|------|------|-------|------|------|-----|-----|-----|----|-------|---------|
|       | Digital     |      |      |       |      |      |     |     |     |    |       | \$ 3.95 |
| NSC   | Linear .    |      |      |       |      |      |     | •   |     |    |       | 4.95    |
|       | Linear A    |      |      |       |      |      |     | ÷   |     |    |       | 2.95    |
| NSC   | Linear A    | V/N  | Vo   | I. II |      |      |     |     |     |    |       | 2.95    |
| NSC   | <b>CMOS</b> |      |      |       |      |      |     |     |     |    |       | 2.95    |
| NSC   | Audio .     |      |      |       |      |      |     |     |     |    |       | 2.95    |
| NSC   | Voltage     | Reg  |      |       |      |      |     |     |     |    |       | 2.95    |
| NSC   | Memory      |      |      |       |      |      |     |     |     |    |       | 3.95    |
| NSC   |             |      |      |       |      |      |     |     |     | ÷  |       | 3.95    |
| NSC   | Special     | Fun  | ctic | ons   | •    |      |     |     |     |    |       | 3.25    |
|       | Mos/LS      |      |      |       |      |      |     |     |     |    |       | 4.25    |
| NSC   | Transist    | ors  |      |       | ž.   |      |     |     |     |    |       | 2.95    |
|       | Micropr     |      |      |       |      |      |     |     |     |    |       | 7.95    |
|       | Comple      |      |      |       |      |      |     |     |     | ĵ. | 2     | 99.50   |
|       | MCS80       |      |      |       |      |      |     |     |     | 0  |       | 4.95    |
| Intel | MCS40       | Mar  | ua   |       |      |      |     |     |     | 0  | 2     | 4.95    |
| Intel | MCS8 N      | /anu | al   | 2     | ŝ    | ů.   |     |     | ì   | :  |       | 2.95    |
| Rayt  | theon Li    | near |      | 0     | 0    | 8    | 101 |     | •   | ô  |       | 2.95    |
|       | theon Qu    |      |      |       |      |      |     |     |     | :  | 0     | 1.95    |
|       | inear Co    |      |      |       |      |      |     |     |     |    | â     | 4.95    |
|       | orne Intr   |      |      |       |      |      |     |     |     |    | •     | 7.50    |
|       | rne Intr    |      |      |       |      |      |     |     |     | •  | •     | 12.50   |
|       | rne 808     |      |      |       |      |      |     |     |     | Ď. | tian  |         |
| Osbo  | rne 680     | 0 Pr | oar  | amı   | mir  | י פי | -   | -0, | g,c | 26 | a.A.ı | 7.50    |
| 0.00  | 000         | •    | og.  |       | •••• | .8   | 3   | •   | •   |    |       | 7.50    |

AY38500-1/TM\$ 1955 ONLY \$16.95 AY38500 (Europe Version) ONLY \$24.95 TV KIT NO. 1 PCB, Chip Instr. \$29.95 TV KIT NO. 2 Parts less chassis \$39.95 Special GI Reject Complete Game \$14.95 ea. (Repairable-sold for \$89.95) MM57100 NSC TV Game Chip . \$16.95 MM53104 Clock Driver . . . . 3.75 LM1889 Modulator . . . . 3.00

TV GAMES

RF Modulator Model 1021 Assembled \$8.95

| SPECIA            | LS           |   |
|-------------------|--------------|---|
| 8T97              | \$1.49       |   |
| 8T26              | 2 for \$4.95 |   |
| 8097/74367        | 6 for \$5.00 | - |
| 1488              | \$1.25       |   |
| 1489              | \$1.25       |   |
| DM8130            | 2 for \$4.95 |   |
| DM8131            | 2 for \$4.95 |   |
| MH0026            | \$2.95       |   |
| 75452             | 10/2.50      |   |
| 74LS138           | \$1.39       |   |
| 74166             | \$ .69       |   |
| 741HC             | 10/2.50      |   |
| 93L00             | 10/3.50      |   |
| LM301AH           | 10/2.50      |   |
| LM308H            | 10/4.95      |   |
| MC1733CL          | 10/4.95      |   |
| 7438              | 10/2.50      |   |
| 4558              | 10/4.95      |   |
| 8T22A             | 10/2.95      |   |
| 8835              | \$1.95       |   |
| 8836              | \$1.95       |   |
| 8837              | \$1.95       |   |
| 8098/74368        | 6/5.00       |   |
| 1702A-6           | 10/39.95     |   |
| 2708              | \$27.08      |   |
| 21L02-1           | 8/12.95      |   |
| P2102             | 16/17.95     |   |
| 74125             | 10/3.75      |   |
| LM323K            | 2/12.95      |   |
| MCT2              | .99          |   |
| WD4060 22 pin     | 3.25         |   |
| 1771 Floppy       | 59.95        |   |
| Plus huge backu   | p inventory  |   |
| with special pric | ing for      |   |
| VOLUME requir     | ements.      |   |
| Call for a quotat |              |   |

COMPUTER KITS MOT MEK6800 D2 235.00 KIM I 6502 Kit 245.00 AMI EVK 99 Kit 133.00 Intercept JR 6100 Kit 281.00 lasis Computerbook NSC Scamp Kit 450.00 99.00 NSC Keyboard Kit 95.00 IMSAI 8080A w/22 751.00 **PIC-8 Priority** 125.00 SIO Kit 125.00 Cromemco Z-2 595.00 Byte Saver 145.00 Bytesaver w/PROM 195.00 Dazzler 215.00 145.00 JS-1 Joystick 65.00 8K EPROM/RAM Kit 124.95 295.00 **ZPU Kit** 

S-100 COMPATIBLE PRODUCTS Logos I 8K Ram Board Intro 801C 8K Ram Board 8 Slot Mother Board (Expandable) 8 Slot Mother Board (Expandable) w/Connectors Extender Board Universal Proto Board w/Instructions 32K Static Ram Board Kit (Allow 30 Days) Tarbell Cassette I/O \$120.00

All Shipments FCM or UPS. Orders under \$100.00 add 5% handling and postage. Orders over \$100.00 add 2.5% handling & postage. Mastercharge/Bank-americard/COD accepted w/25% deposit. California Residents add 6% tax. Foreign Orders add 8% handling. All parts prime factory tested guaranteed. Sal shipment. Add 25 cents for Data.

| CHAR GEN/ENCODERS/UA      | DTC   |
|---------------------------|-------|
| OTIALI GENERALINGODENS/OF | 4013  |
| \$1883 6.95 \$2350 USRT   | 10.95 |
| 1602B 5.50 1671B Astros   | 29.95 |
| AY51013A 5.50 1482        | 13.95 |
| AY51015A 9.95 1472        | 13.95 |
| MM5320 TV Synch Gen       | 7.95  |
| MM5369 Prescaler          | 3.95  |
| MM5376 Calc Chip          | 2.95  |
| CT5001 Calc Chip          | 2.95  |
| CT7001 Clock Chip         | 5.95  |
| MM5314 Clock Chip         | 4.95  |
| MM5316 Clock Chip         | 4.95  |
| MM5375 Clock Chip         | 4.95  |
| R032513 Lower Case        | 10.95 |
| R032513 Uppercase         | 9.95  |
| AY52376 Keyboard Encoder  | 14.95 |
| AY53600 Keyboard Encoder  | 14.95 |
|                           | 19.95 |
| MM6574 Char gen           | 19.95 |
| MM6575 Char gen           | 19.95 |

SPECIALTY CHIPS 34702 Band Rate Gen upD372 Floppy Controller upD371 Mag Tape Controller App Notes for 372 Floppy 55.00 6.95 WD1771 Floppy Controller AY5 3550 4% DVM Chip 8038CC Wave Gen 69.95 24.95 3.50 6.95 MK5007 Counter AY5 3507 DVM Chip 12.95 WD1941 Dual Baud Gen 9.95 ICM7208IPI 16.95 ICM7045IPI

Retail pricing may vary from Mail Order pricing.

MC14411 Baud

**OMPUTER** 

P. O. BOX 17329 Irvine, California 92713 New Phone (714) 558-8813

Our First Store Open 1310 B Edinger Santa Ana, CA 92705 NOW

12.95

SOFTWARE DEVELOPMENT

# HIGH DENSITY TAPE PUNCH **BIPNCH**

By permission and courtesy of Motorola's M6800 User Group Library

> 00017 00018

> 00019

00020

00021

00022

00023

00024

00025

00026

00027

00028

00029

00030

00031

00032

00033

00034

00035

00036

00037

00038

00039

00040

00041 00042

00043

FUNCTION:

Punches a properly formatted binary paper tape from memory for loading

with the biload program.

**RESULTS:** 

A binary paper tape is produced.

**HARDWARE** 

EXORciser and teletype with auto-CONFIGURATION: matic punch control. However, the

program could be modified to work with a teletype with manual punch

control.

**MEMORY** REQUIRED: The program resides in memory from \$ID70 through \$IE97. Plus memory

is required to contain the data to be

punched.

SOFTWARE

SUPPORT:

EXBUG 1.1

ASSEMBLER/

COMPILER:

EXORciser Resident Assembler.

AFTER LOADING, THE PROGRAM IS ENTERED BY 00009 TYPING ; P AFTER ENTERING MAID. THE PROGRAM 00010 00011 THEN PRINTS: BINARY TAPE PUNCH 00012 00013 NEXT THE PROGRAM PRINTS "PUNCH" AND WAITS 00014 FOR AN INPUT CHARACTER. THE FOLLOWING 00015 OPTIONS ARE AVAILABLE: 00016

PUNCHES 8 INCHES OF

PUTS EXBUG ENTRY ADDRESS E

IN G BLOCK PUTS MAID ENTRY ADDRESS

PUTS NAME IN G BLOCK. FOUR HEY CHARACTERS MUST

BE ENTERED PINCHES DATA BLOCK FROM

MEMORY AFTER REQUESTING BEGINNING AND ENDING ADDRESSES AS EXBUG DOES. ENTERING X DURING THE ADDRESS CONVERSATION CAUSES THE PROGRAM TO

ABORT TO EXBUG. ABORTS TO EXBUG

BEFORE PUNCHING ON THE E.M.G. OR D COMMANDS THE PROGRAM PRINTS "EXEC" AND WAITS FOR AN INPUT. TYPING Y CAUSES EXECUTION OF THE COMMAND. TYPING N CAUSES THE SCAN LOOP TO BE REENTERED. TYPING ANY OTHER CHARACTER CAUSES THE EXEC CONVERSATION

TO REPEAT.

REV: 0

# **BIPNCH ASSEMBLY LISTING**

| 00001 | NAM BIPNCH  |   |
|-------|---|---|
| 00003 | * NAM: BIPNCH VER: 1. 0 DAT: 07-14-75 CMP: M6800              |   |
| 00004 | ±   |   |
| 00005 | * SYS: M68RES (EXBUG 1.1)                                     |   |
| 00006 | <b>*</b>  |   |
| 00007 | # DES: THIS PROGRAM PUNCHES A BINARY TAPE FROM                |   |
| 80000 | <ul> <li>MEMORY FOR LOADING WITH THE BILOAD PROGRA</li> </ul> | M |
|       |   |   |

| 00045 |      | OPT         | 0,5    |                         |
|-------|------|-------------|--------|-------------------------|
| 00047 |      | * EQUATES   |        |                         |
| 00049 | FF8A | STACK EQU   | \$FF8A | EXBUG STACK AREA        |
| 00050 | F024 | PDATA EQU   | \$F024 | PRINT CR LF DATA STRING |
| 00051 | F02A | PSPACE EQU  | \$F02A | PRINT SPACE             |
| 00052 | F015 | INCHINP EQU | \$F015 | INPUT CHAR-NO PARITY    |
| 00053 | FA4E | INXCH EQU   | \$FA4E | INPUT CHAR-ABORT IF X   |
| 00054 | FB7F | EXEC EQU    | \$FB7F | /EXEC/                  |
| 00055 | FA68 | INADD EQU   | \$FA68 | GET HEX ADDR-4 CHARS    |
| 00056 | FF08 | TEMPA EQU   | \$FF08 | START ADDR STORAGE      |
| 00057 | FF07 | TEMP EQU    | \$FF07 | START ADDR CHAR COUNT   |
|       |      |             |        |                         |

# S.D. SALES CO. P.O. BOX 28810 - E DALLAS, TEXAS 75228

# ★ Imsai - Altair "A" Compatible Kits ★ Z-80 CPU KIT COMPLETE - \$149. kit

Z-80 Chip & Manual \$49.95

Z-80 Manual - \$7.50 Separately

From the same people who brought you the \$89.95 4K RAM KIT. We were not the first to introduce an Imsai/Altair compatible Z-80 Card, but we do feel that ours has the best design and quality for the lowest price!

The advance features of the Z-80 such as an expanded set of 158 instructions, 8080A software compatibility, and operation from a single 5VDC supply, are all well known. What makes our card different is the extra care we took in the hardware design. The CPU card will always stop on an M1 state. We also generate TRUE SYNC on card, to insure that the rest of your system functions properly. Dynamic memory refresh and NMI are brought out for your use. Believe it or not, not all of our competitors have gone to the extra trouble of doing this.

As always this kit includes all parts, all sockets, and complete instructions for ease of assenting. Because of our past experience with our 4K kit we suggest that you order early. All orders will be shipped on a strict first come first served basis. Dealers inquiries welcome on this item. Kit includes Zilog Manual and all parts. Kit shipped with 2 MHZ crystals.

THE WHOLE **WORKS** \$89.95

# **4K LOW POWER RAM BOARD KIT**

Imsai and Altair 8080 plug in compatible. Uses low power static 21L02-1 500 ns. RAM'S. Fully buffered, drastically reduced power consumption, on board regulated, all sockets and parts included. Premium quality plated through PC Board. For 250 ns RAM's add \$10.00

# NEW! DESIGN CONSOLETTE KIT - \$89.95

S.D. Sales announces the inexpensive way to beat the wire wrap jungle. Our latest kit gives you 124 solderless quick connect terminals, enough for eight 16 pin IC's and provides 50 x 8 common buss matrix. Has regulated +5VDC and +/- 15VDC, all at 1 AMP. Voltage regulation at 100%. Also includes a pulse generator variable from 10hz to 50mhz and .01 sec. to 100 nano seconds. Generator output is +5V. In kit form only and includes all parts, sockets; front panel measures 7\\(^1\)\cdot \cdot 8\(^1\)\cdot \cdot \cdot 20 mhz and hardware. case not available.

CAR/BOAT KIT MW \$34.95

Music to your Ears!

Musical Horn Kit for car, boat, or home. Plays any tune from Mozart to Led Zeppelin. Change tunes in seconds; complete solid state electronics. Standard or custom tunes available at \$6.95 each (you supply us with the sheet music — we supply electronics for your favorite tune.) One song supplied with original order. Standard tunes available: DIXIE — EYES OF TEXAS — ON WISCONSIN — YANKEE DOODLE DANDY — NOTRE DAME FIGHT SONG — PINK PANTHER — AGGIE WAR SONG — ANCHORS AWAY — NEVER ON SUNDAY — BRIDGE OVER RIVER QUI — CANDY MAN.

HOME KIT

er. Uses standard 80hm PM spea Allow 4 weeks delivery on both kits.

Limited Quantity! **\$9.95** kit

# 6 DIGIT ALARM CLOCK KIT

We made a fantastic kit even better. Redesigned to take advantage of the latest advances in IC technology. Features: Litronix Dual %" displays, Mostek 50250 super clock chip, single I.C. segment driver, SCR digit drivers. Greatly simplified construction. More reliable and easier to build. Kit includes all necessary parts (except case). For P.C. board add \$3.00; AC XFMR add \$1.50. Do not confuse with Non-Alarm kits sold by our competition! Eliminate the hassle — avoid the 5314!

NEW! WITH JUMBO LED READOUTS!

SLIDE SWITCH
Assortment
Our best seller. Includes
miniature and standard
sizes, single and multiposition units. All new.

POWER RESISTOR **15 OHM** 25W BY CLAROSTAT

RESISTOR ASSORTMENT %W 5% & 10% PC leads. A good mix of values! Special!

P.C. LEAD DIODES 1N4148/1N914 100/\$2. 1N4002 - 1A 100 PIV

Just received a good mixed lot of National TO-92 plastic transis-tors. PNP & NPN, even a few FET's. 40-50% yield. Untested Asst.

DISC CAP ASSORTMENT ASSORTMENT P.C. Leads. At least 10 different values. Includes .001, .01, .05 plus other standard values.

4/\$1.00

12/\$1.00

75¢ ea.

200/\$2.

40/\$1.

500/\$3.

60/\$1.00

AMD-1702A

Huge Factory Purchase

**FACTORY PRIME UNITS! BRAND NEW!** 1.5 Micro-Seconds Access Time.

10/\$40. \$4.95 ea.

|     | 4  | v. |   |  |
|-----|----|----|---|--|
| _   | _/ | L  | _ |  |
| `   |    | P  |   |  |
| - 1 | •  | 9  |   |  |

3.579545

MHZ Time Base Crystal

\$1.25

28 PIN SOCKETS

Special!



Computer Grade Cap

\$3.00 each 39 MFD

16 V Mallory

Electrolytic 15 for \$1.00

11,000 MFD 50WVDC

21L02-1 Not only are our RAM'S faster than a speeding bullet but they are now very low power. We are pleased to offer prime new 21L02-1 Low Power and Super Fast RAM's. Allows you to STRETCH your power supply farther and at the same time keep the wait light off!

500ns 8/\$12.95 250ns 8/\$15.95

FACTORY PRIME!

IC'S REMOVED FROM PC BOARDS PC BOARDS ALL TESTED; FULL SPEC.

# IC's from XEROX

1402 A Shift Regulator — 50c MH0025CN — 55c

| 7400 - 9c  | 7430 - 9c  | 7493 —26c         |
|------------|------------|-------------------|
| 7402 - 9c  | 7440 - 9c  | 74121 - 22c       |
| 7404 - 9c  | 7437 - 10c | 74123 -32c        |
| 7406 -11c  | 7438 -10c  | 74151 - 9c        |
| 7407 -11c  | 7451 - 9c  | 74155 -22c        |
| 7410 - 9c  | 7474 - 16c | 74193 -35c        |
| 7416 - 13c | 7475 - 24c | 8233 - 35c        |
| 7420 - 9c  | 7486 -16c  | Intel - 1302 - 45 |
|            |            |                   |

# MOS 6 DIGIT UP/DOWN COUNTER

40 PIN DIP. Everything you ever wanted in a counter chip. Features: Direct LED segment drive, single power supply (12 VDC TYPE), six decades up/down, pre-loadable counter, separate pre-loadable compare register with compare out-put. BCD and seven segment outputs, internal scan oscillator, CMOS compatible, leading zero blanking. 1MHZ. count input frequency.

Exclusive!

**AMERICARD** OR MASTER CHARGE ORDER IN ON OUR CONTINENTAL UNITED STATES **TOLL FREE WATTS LINE:** 

1-800-527-3460

Texas Residents Call Collect: 214/271-0022

TERMS: Money Back Guarantee!

NO COD'S. TEXAS RESIDENTS ADD 5% SALES TAX. ADD 5% OF ORDER FOR POSTAGE & HANDLING. ORDERS UNDER \$10.00 ADD 75c. FOREIGN ORDERS - U.S. FUNDS ONLY!

Orders over \$15. - Choose \$1. FREE MERCHANDISE!

164 INTERFACE AGE **CIRCLE INQUIRY NO. 90** AUGUST 1977

SOFTWARE DEVELOPMENT

| 00058 F9CF       | OCHAR    | EQU     | \$F9CF        | OUTPUT CHAR            | 00093      | 1D97 | 20 22   |        | BRA     | PSTRT     | PUNCH IT             |
|------------------|----------|---------|---------------|------------------------|------------|------|---------|--------|---------|-----------|----------------------|
| 00059 F564       | EXBUG    | EQU     | \$F564        | EXBUG ENTRY            | 00094      | 1D99 | 81 4D   | SCAN5  | CMP A   | #'M       | MAID ENTRY?          |
| 00060 F0F3       | MAID     | EQU     | \$F0F3        | MAID ENTRY             | 00095      | 1D9B | 26 08   |        | BNE     | SCAN9     | NO                   |
| 00061 F021       | PCRLF    | EQU     | \$F021        | PRINT LF CR NULLS      | 00096      | 1D9D | CE FOF3 |        | LDX     | #MAID     | YES-SET START ADDR   |
| 00062 F003       | BEGENT   | EQU     | \$F003        | INPUT BEG AND END ADDR | 00097      | 1DAO | FF FF08 |        | STX     | TEMPA     |                      |
| 00063 FF0A       | BEGA     | EQU     | \$FF0A        | BEGINNING ADDR         | 00098      | 1DA3 | 20 16   |        | BRA     | PSTRT     | PUNCH IT             |
| 00064 , FF0C     | ENDA     | EQU     | \$FFOC        | ENDING ADDR            | 00099      | 1DA5 | 81 47   | SCAN9  | CMP A   | #'G       | ADDRESS ENTRY?       |
| 00065 FF5A       | T₩       | EQU     | \$FF5A        | TEMP ADDR STORAGE      | 00100      | 1DA7 | 26 DO   |        | BNE     | SCAN      | NO-TRY AGAIN         |
| 00066 FF62       | CASSET   | EQU     | \$FF62        | PUNCH ON FLAG          |            |      |         |        |         |           |                      |
| 00067 FCF5       | MTTYDI   | EQU     | \$FCF5        | MAID TTY DATA IN       | 00102      | 1DA9 | BD FOZA |        | JSR     | PSPACE    | PRINT SPACE-GET ADDR |
|                  |          |         |               |                        | 00103      | 1DAC | CE FF08 |        | LDX     | #TEMPA    | INZ X-REG            |
|                  |          |         |               |                        | 00104      | 1DAF | 86 01   |        | LDA A   | #1        | INZ CHAR COUNT       |
|                  |          |         |               |                        | 00105      | 1DB1 | B7 FF07 |        | STA A   | TEMP      |                      |
| 00010            |          | D DC01  | OTED 1 00A    | TT.CA1                 | 00106      | 1DB4 | BD FA68 |        | JSR     | INADD     | GET ADDR             |
| 00069            | * SET    | P-MEGI  | SIER LUCA     | ITUN                   | 00107      | 1DB7 | C1 05   |        | CMP B   | #5        | 4 HEX CHARS?         |
| 00074 5544       |          | 000     | AFE 4.4       |                        | 00108      | 1DB9 | 26 BE   |        | BNE     | SCAN      | NO                   |
| 00071 FF16       |          | ORG     | \$FF16        |                        |            |      |         |        |         |           |                      |
| 00072 FF16 1D70  |          | FDB     | START         |                        |            |      |         |        |         |           |                      |
| 00074            | # STA    | RT OF B | IPNCH         |                        |            |      |         |        |         |           |                      |
|                  |          |         |               |                        |            |      |         |        |         |           |                      |
| 00076 1D70       |          | ORG     | \$1D70        |                        | 00110      |      |         | # PSTI | RT ROUT | INE TO PU | INCH G BLOCK         |
| 00077 1D70 8E FI | 8A START | LDS     | #STACK        | INZ STACK              |            |      |         |        |         |           |                      |
| 00078 1D73 CE 11 | 85       | LDX     | #HDNG         | PRINT HEADING          | 00112      | 1DBB | BD 1E45 | PSTRT  | JSR     | CEXEC     | PUNCH IT?            |
| 00079 1D76 BD F  | 24       | JSR     | PDATA         |                        | 00113      | 1DBE | BD F021 |        | JSR     | PCRLF     | YES-SPACE DOWN       |
|                  |          |         |               |                        | 00114      | 1DC1 | BD 1E5B |        | JSR     | PUNON     | TURN PUNCH ON        |
| 00081 1D79 CE 11 | 91 SCAN  | LDX     | #PUNCH        | SCAN LOOP-PRINT PUNCH  | 00115      | 1DC4 | 86 47   |        | LDA A   | #'G       | PUNCH G              |
| 00082 1D7C BD F  | 24       | JSR     | <b>PDATA</b>  |                        | 00116      | 1DC6 | BD F9CF |        | JSR     | OCHAR     |                      |
| 00083 1D7F BD F  | 14E      | JSR     | INXCH         | INPUT CHAR-ABORT IF X  | 00117      | 1DC9 | Œ FF08  |        | LDX     | #TEMPA    | SET X-REG TO ADDR    |
| 00084 1D82 81 44 | l .      | CMP A   | #'D           | PUNCH DATA?            | 00118      | 1DCC | BD 1E69 |        | JSR     | PUN       | PUNCH ADDR HI        |
| 00085 1D84 27 5  | }        | BEQ     | PUNDAT        | YES                    | 00119      | 1DCF | BD 1E69 |        | JSR     | PUN       | PUNCH ADDR LOW       |
| 00086 1D86 81 46 | ;        | CMP A   | #'L           | PUNCH LEADER?          | 00120      | 1DD2 | BD F021 |        | JSR     | PCRLF     | PUNCH LF CR NULLS    |
| 00087 1D88 26 03 | 3        | BNE     | SCAN3         | NO                     | 00121      | 1DD5 | BD 1E76 |        | JSR     | PUNOFF    | TURN PUNCH OFF       |
| 00088 1D8A 7E 1  | 35       | JMP     | PUNLED        | YES                    | 00122      | 1008 | 20 9F   | XSCAN  | BRA     | SCAN      | GO SCAN              |
| 00089 1D8D 81 45 | SCAN3    | CMP A   | *'E           | EXBUG ENTRY?           | 00124      |      |         | # PUN  | DAT RO  | UTINE TO  | PUNCH DATA BLOCK     |
| 00090 1D8F 26 0  | 3        | BNE     | SCAN5         | NO                     | 196 (1979) |      |         |        |         |           |                      |
| 00091 1D91 CE F  |          | LDX     | <b>#EXBUG</b> | YES-SET START ADDR     | 00126      | 1DDA | BD F003 | PUNDAT | JSR     | BEGEND    | GET BEG AND END ADDR |
| 00092 1D94 FF FI | 08       | STX     | TEMPA         |                        | 00127      | 1DDD | BD 1E45 |        | JSR     | CEXEC     | DO IT?               |
|                  | 400      |         |               |                        |            |      |         |        | 200     |           |                      |

# THE PARTS TERMINAL

P.O. Box 2143 Orcutt, Ca. 93454 (805) 922-0714

ALL PARTS ARE BRAND NEW, PRIME, 1st QUALITY. NO COSMETIC REJECTS OR SECONDS SOLD

# Computer Iransformers

MULTI-TAPED PRIMARY 106-117 V 208-230 V SECONDARY, 36V AC CT AT 3A., 18VCT AT 7A., PERFECT FOR MICROPROCESSORS.

\$ 24.50 ea

MICRO MINATURE PC MOUNT TRANS-FORMER 117 VAC PRIMARY, 2 OUTPUTS WESTERN DIGITAL UART CHIP 30VCT AT 300MA, 18VCT AT 300MA. SIZE: 1 3/8L, 1 1/8W, 1H. PERFECT TRANS/REC BAUD RATES UP FOR MICRO MINATURE APPLICATIONS! \$ 5.63 ea ANY QUANTITY

# 4K Memory Chip

MOTOROLA MCM660P 4Kx1 DYNAMIC MEMORY CHIP 16 PIN PLASTIC - 1st QUALITY 100% TESTED AND BURNED IN. PIN FOR PIN COMPATABLE TO THE POPULAR 4096

\$ 3.95 ea ANY QUANTITY

# TR 1602B UART

UNIVERSAL ASYNCHRONOUS TO 20K BAUD-NEW-PRIME \$ 4.00 ea ANY QUANTITY

No C.O.D.'s.-Master Charge, Bof A or Visa Accepted Personal Checks Require 2-3 Weeks to Clear.

ZILOG Z-80 CPU CHIP, PRIME 1st QUALITY - NO FALLOUTS OR COSMETIC REJECTS! \$ 23.50 ea ANY QUANTITY

Video Monitor PANASONIC TR-920 M AC-DC OPERATION WITH ATTRACTIVE CASE. PERFECT FOR CRT OR CCTV APPLICATIONS \$ 122.50 ea

1K EPROM 2708 1Kx3 E PROM – PRIME 1st QUALITY- THESE ARE TOP OF THE LINE, NO FALLOUTS OR COSMETIC REJECTS SOLD! \$ 22.00 ea ANY QUANTITY

All Orders Shipped Same Day as Received

|   | DEO BD                                   |                  |              | JSR               | PCRLF          | YES-SPACE DOWN      |       |                    |             | PON20  |              |            | TURN PUNCH ON                  |
|---|--|------------------|--------------|-------------------|----------------|---------------------|-------|--------------------|-------------|--------|--------------|------------|--------------------------------|
|   | DE3 BD                                   |                  |              | JSR               | PUNON          | TURN PUNCH ON       |       | 1E65 BI            |             |        | JSR          | OCHAR      |                                |
|   | DE6 FE                                   |                  |              | LDX               | BEGA           | TEMP BEGINNING ADDR | 00200 | 1E68 39            | )           |        | RTS          |            |                                |
|   | DE9 FF                                   |                  |              | STX               | TW             |                     |       |                    |             |        |              |            |                                |
|   |  |                  | PUND10       |                   | ENDA+1         | FORM END-TEMP BEG   |       |                    |             |        |              |            |                                |
|   | DEF FO                                   |                  |              |                   | TW+1           |                     |       |                    |             |        |              |            |                                |
|   | DF2 B6                                   |                  |              |                   | ENDA           |                     | 00000 |                    |             |        | ~~~          | DATA DUT   | T POURTE                       |
|   | DF5 B2                                   |                  |              | SBC A             |                |                     | 00202 |                    |             | * PUN  | PUNCH        | DAIA BY    | E ROUTINE                      |
|   | DF8 27                                   |                  |              | BEQ               | PUND25         | DIF(255             | 00004 | 1510 4             |             | D4 B4  |              | u .        | OCT DATA                       |
|   | DFA C6                                   |                  |              |                   | #\$FF          | YES-SET BLOCK=256   |       | 1E69 A             |             | PUN    | LDA A        |            | GET DATA                       |
|   |  |                  | PUND25       |                   |                | PUNCH B             |       | 1E6B BI            |             |        | JSR<br>ADD D | OCHAR      | PUNCH IT                       |
|   | DFE BD                                   |                  |              | JSR               | OCHAR          | DIRECT DIVITE COURT |       | 1E6E EI            |             |        | ADD B        | ٨          | UPDATE CHKSUM                  |
|   | E01 37                                   |                  |              | PSH I             |                | PUNCH BYTE COUNT    |       | 1E71 8             |             |        | CMP A        | Be14       | update addr<br>Char=punch off? |
|   | E02 5F                                   |                  |              | CLR I             | 1              | INZ CHKSUM          |       | 1E73 2             |             |        | BEQ          | PON20      | YES-TURN PUNCH ON              |
|   | E03 30                                   |                  |              | TSX               |                |                     |       | 1E75 39            |             |        | RTS          | runz0      | 125-10KN FUNCT UN              |
|   | E04 8D                                   |                  |              | BSR               |                |                     | 00210 |                    | ,           | a DIN  |              | NOU OFF C  | UBROUTINE                      |
|   | E06 32                                   |                  |              | PUL A             |                | GET BYTE COUNT      | VV212 |                    |             | - FUN  | wr ru        | ANGE OFF S | ODAWO I INC.                   |
|   | E07 40                                   |                  |              | INC A             |                | ADJUST IT           | 00214 | 1F76 R             | 5 14        | PUNOFF | I DA A       | 241A       | TURN PUNCH OFF                 |
|   | E08 B7                                   |                  |              |                   | TEMP           | SAVE IT             |       | 1E78 B             |             |        | JSR          | OCHAR      | TWIN TOWN UT                   |
|   | EOB CE                                   |                  |              | LDX               | #TW            | PUNCH ADDR          |       |                    |             | POFF10 |              | CASSET     | RESET PUNCH ON FLAG            |
|   | EOE 8D                                   |                  |              | BSR               | PUN            |                     |       | 1E7E B             |             |        |              | MTTYDI     | RESET ACIA INPUT BUFFI         |
|   | E10 8D                                   |                  |              | BSR               | PUN            | DIRKYL DATA         |       | 1E81 B             |             |        |              | MTTYDI     | neser noin in or borr          |
|   | E12 FE                                   |                  |              | LDX               | TW             | PUNCH DATA          |       | 1E84 3             |             |        | RTS          |            |                                |
|   |  |                  | PUND30       |                   | PUN            | DOMES .             |       |                    |             |        |              |            |                                |
|   | E17 76                                   |                  |              | DEC               | TEMP<br>Pund30 | DONE?<br>NO         |       |                    |             |        |              |            |                                |
|   | IE1A 26<br>IE1C FF                       |                  |              | STX               | TM             | SAVE ADDR           |       |                    |             |        |              |            |                                |
|   | E1F 53                                   |                  |              | COM               |                | PUNCH CHKSUM        |       |                    |             |        |              |            |                                |
|   | E20 37                                   |                  |              | PSH 1             |                | runch chroun        |       |                    |             |        |              |            |                                |
|   | E21 30                                   |                  |              | TSX               | ,              |                     | 00221 |                    |             | # MES  | SAGES        |            |                                |
|   | E22 80                                   |                  |              | BSR               | PUN            |                     |       |                    |             |        |              |            |                                |
|   | E24 33                                   |                  |              | PUL I             |                |                     | 00223 | 1E85 4             | 2           | HDNG   | FCC          | !BINARY    | TAPE !                         |
|   | IE25 BI                                  |                  |              | JSR               | PCRLF          | PUNCH LF CR NULLS   |       | 1E86 4             | 9           |        |              |            |                                |
|   | 1E28 FE                                  |                  |              | LDX               | TW             | DONE?               |       | 1E87 4             | Ε           |        |              |            |                                |
|   | 1E2B 09                                  |                  |              | DEX               |                | <del>-</del> -      |       | 1E88 4             | 1           |        |              |            |                                |
|   | 1E2C BO                                  |                  |              | CPX               | ENDA           |                     |       | 1E89 5             | 2           |        |              |            |                                |
|   | 1E2F 26                                  |                  |              | BNE               | PUND10         | NO                  |       | 1E8A 5             | 9           |        |              |            |                                |
|   | E31 80                                   |                  |              | BSR               | PUNOFF         | YES-TURN PUNCH OFF  |       | 1E8B 2             | 0           |        |              |            |                                |
| 166 1                                     | 1E33 20                                  | A3               |              | BRA               | XSCAN          | go scan             |       | 1E8C 5             | 4           |        |              |            |                                |
| 168                                       |  |                  | * PUN        | LED               | ROUTINE TO     | PUNCH LEADER        |       | 1E8D 4             | 1           |        |              |            |                                |
|   |  |                  |              |                   |                |                     |       | 1E8E 5             | 0           |        |              |            |                                |
| 170 1                                     | 1E35 BI                                  | 1E5B             | PUNLED       | JSR               | PUNON          | TURN PUNCH ON       |       | 1E8F 4             | 5           |        |              |            |                                |
|   | 1E38 C4                                  | 46               |              | LDA               | B #70          | 70=7 INCHES         |       | 1E90 2             |             |        |              |            |                                |
|   |  |                  |              | CLR               | A              | NULL                | 00224 | 1E91 5             | 0           | PUNCH  | FCC          | !PUNCH !   |                                |
| 171                                       | IE3A AF                                  |                  |              | ICO               | OCHAR          | PUNCH IT            |       | 1E92 5             | 5           |        |              |            |                                |
| 171 1<br>172 1                            | IE3A 4F                                  |                  | PUNL10       | JOH               |                |                     |       | 1E93 4             | E           |        |              |            |                                |
| 171 1<br>172 1<br>173 1                   |  | F9CF             | PUNL10       | DEC               |                | DONE?               |       |                    | _           |        |              |            |                                |
| 171 1<br>172 1<br>173 1<br>174 1          | E3B BI                                   | F9CF             | PUNL10       |                   |                | DONE?<br>NO         |       | 1E94 4             |             |        |              |            |                                |
| 171 1<br>172 1<br>173 1<br>174 1          | 1E3B BI<br>1E3E 54                       | F9CF<br>FA       | PUNL10       | DEC               | В              |                     |       | 1E94 4:<br>1E95 4: | 3           |        |              |            |                                |
| 171 1<br>172 1<br>173 1<br>174 1<br>175 1 | 1E3B BI<br>1E3E 54<br>1E3F 26<br>1E41 BI | F9CF<br>FA<br>33 | PUNL10 YSCAN | DEC<br>BNE<br>BSR | B<br>PUNL10    | NO                  |       |                    | 3<br>B<br>0 |        |              |            |                                |

| 00179 |      |   |      | *  | CEX | EC  | EXECUTE | CON | ÆRSATI | DN | ROUTINE |
|-------|------|---|------|----|-----|-----|---------|-----|--------|----|---------|
| 00181 | 1E45 | Œ | FB7F | CE | KEC | LDX | #EXI    | EC  | PRINT  | E) | ŒC      |

| 00101 | 1510 | ·  | 1 0/1 | CENEC  | LDA |   | MEVER        | INTIVI EXEC       |
|-------|------|----|-------|--------|-----|---|--------------|-------------------|
| 00182 | 1E48 | BD | F024  |        | JSR |   | <b>PDATA</b> |                   |
| 00183 | 1E4B | BD | F015  |        | JSR |   | INCHINP      | INPUT CHAR        |
| 00184 | 1E4E | 81 | 4E    |        | CMP | A | #'N          | N?                |
| 00185 | 1E50 | 26 | 04    |        | BNE |   | CEXE10       | NO                |
| 00186 | 1E52 | 31 |       |        | INS |   |              | YES-CORRECT S-REG |
| 00187 | 1E53 | 31 |       |        | INS |   |              |                   |
| 00188 | 1E54 | 20 | ED    |        | BRA |   | YSCAN        | ABORT             |
| 00189 | 1E56 | 81 | 59    | CEXE10 | CMP | A | #'Y          | Y?                |
| 00190 | 1E58 | 26 | EB    |        | BNE |   | CEXEC        | NO                |
| 00191 | 1E5A | 39 |       |        | RTS |   |              |                   |

### 00193 \* PUNON PUNCH ON SUBROUTINE

| 00195 | 1E5B | 7C  | FF62 | PUNON | INC   | CASSET | SET PUNCH ON FLAG           |
|-------|------|-----|------|-------|-------|--------|-----------------------------|
| 00196 | 1E5E | 86  | 7F   | PON10 | LDA A | #\$7F  | SEND RUBOUT BEFORE PUNCH ON |
| 00197 | 1FAO | RTI | EOCE |       | .ICR  | OCHAD  |                             |

| 00227   |        |              |      | END           |      |        |      |               |      |
|---------|--------|--------------|------|---------------|------|--------|------|---------------|------|
| STACK   | FF8A   | <b>PDATA</b> | F024 | <b>PSPACE</b> | F02A | INCHNP | F015 | INXCH         | FA4E |
| EXEC    | FB7F   | INADD        | FA68 | TEMPA         | FF08 | TEMP   | FF07 | OCHAR         | F9CF |
| EXBUG   | F564   | MAID         | F0F3 | PCRLF         | F021 | BEGEND | F003 | BEGA          | FF0A |
| ENDA    | FF0C   | TW           | FF5A | CASSET        | FF62 | MTTYDI | FCF5 | START         | 1D70 |
| SCAN    | 1D79   | <b>SCAN3</b> | 1DBD | SCAN5         | 1D99 | SCAN9  | 1DA5 | <b>PSTRT</b>  | 1DBB |
| XSCAN   | 1DD8   | PUNDAT       | 1DDA | PUND10        | 1DEC | PUND25 | 1DFC | PUND30        | 1E15 |
| PUNLED  | 1E35   | PUNL10       | 1E3B | YSCAN         | 1E43 | CEXEC  | 1E45 | CEXE10        | 1E56 |
| PUNON   | 1E5B   | PON10        | 1E5E | PON20         | 1E63 | PUN    | 1E69 | <b>PUNOFF</b> | 1E76 |
| POFF10  | 1E7B   | HDNG         | 1E85 | PUNCH         | 1E91 |        |      |               |      |
| TOTAL I | ERROR: | 00000        |      |               |      |        |      |               |      |

# **BIPNCH OBJECT DUMP**

S00B00004249504E4348202000
\$105FF161D7058
\$11E1D708EFF8HCE1E85BDF024CE1E91BDF024BDFA4E81442754814C26037EF4
\$11E1D708EFF8HCE1E85BDF024CE1F91BDF024BDFA4E81442754814C26037EF4
\$11E1D8B1E3581452608CEF564FFFF082022814C2608CEF0F3FFF78820168119
\$11E1DC3BD1E5B86647BDF9CFCEFF088D1E69BD1E69BD1E921BD1E76209FBDF093
\$11E1DC3BD1E5B86647BDF9CFCEFF088D1E69BD1E69BDF021BD1E76209FBDF093
\$11E1DF75R2782C6FF8642BDF9CF375F308C63324CB7FF07CEFF5R8D598D5756
\$11E1E15FFF5R8D527HFF0726F9FFFF5R5377386D4533BDF021FEFF5R8D598D5756
\$11E1E15FFF5R8D527HFF0726F9FFFF5R5377386D4533BDF021FEFF5R8D59BDF0CF5
\$11E1E48BDF024BDF0F58BD1E5BC6464FBDF9CF5826FR8D332993CEFBF7CC
\$11E1E48BDF024BDF0F58B01258C6464FBDF9CF5826FR8D332993CEFBF7CC
\$11E1E48BDF024BDF0F58B01258C6464FBDF9CF5826FR8D59CFF5
\$11E1E48B0F024BDF0F58B0125B038415045858584BDF9CFFFF5208
\$11D1E7EB6FCF586FCF53942494E41525920544150452050554E4]482004EE
\$9030000FC

# HIGH DENSITY TAPE LOAD BILOAD

By permission and courtesy of Motorola's M6800 User Group Library

00053

00054

00055

00056 00057

00058

00059

**FUNCTION:** 

Loads a properly formatted binary

object paper tape into memory from

a teletype.

**RESULTS:** 

Loads the binary format tape in approximately one-third the time re-

quired for loading a standard EXOR-

ciser format tape.

HARDWARE

CONFIGURATION: EXORciser and teletype.

MEMORY REQUIRED: Loader resides in memory addresses \$10 through \$8D. Plus

memory must be provided at the locations the load tape will require.

**SOFTWARE** 

SUPPORT:

EXBUG 1.1

ASSEMBLER/

COMPILER:

EXORciser Resident Assembler.

# **BILOAD ASSEMBLY LISTING**

00001 NAM BILOAD

00003 \* NAM: BILOAD VER: 1. 0 DAT: 07-07-75 CMP: M6800
00004 \*
00005 \* SYS: MASRES (EXBUG 1. 1)
00006 \*
00007 \* DES: THIS PROGRAM LOADS A PROPERLY FORMATTED
00008 \* BINARY TAPE INTO MEMORY. THE PROGRAM

00009 ACCEPTS THE FOLLOWING TAPE FORMAT: 00010 00011 ASCII B INDICATES THE START OF A 00012 RIMARY DATA BLOCK 00013 BINARY NUMBER OF BYTES OF 00014 BYTE COUNT DATA, EXCLUDING BEGINNING 00015 00016 ADDRESS AND CHECKSUM, MINUS ONE. NOTE THAT A 00017 00018 BLOCK OF ZERO BYTES CANNOT 00019 OCCUR. 00020 **ADDRESS** TWO BINARY FRAMES CONTAINI 00021 THE REGINNING ADDRESS FOR 00022 THIS DATA BLOCK 00023 00024 00025 DATA DATA TO BE STORED INTO 00026 MEMORY IN BINARY FORMAT 00027 00028 CHECKSUM ONE'S COMPLEMENT OF THE SU OF EACH DATA, ADDRESS, AND 00029 00030 BYTE COUNT BYTE IN BINARY 00031 00032 00033 INDICATES BLOCK CONTAINING ASCII G 00034 00035 JUMP ADDRESS USED AT COMPLETION OF LOADING. THE 00036 G BLOCK IS THE LAST BLOCK 00037 00038 00039 TWO BINARY FRAMES CONTAINI 00040 ADDRESS THE . LIMP ARRESS 00041 00042 AFTER LOADING THE PROGRAM IS ENTERED BY 00043 TYPING ; P AFTER ENTERING MAID. 00044 00045 00046 IF DATA CANNOT BE STORED INTO MEMORY THE PROGRAM TYPES "NO CHANGE" AND GOES TO EXBUG. 00047 00048 IF A CHECKSUM ERROR IS DETECTED THE 00049 PROGRAM TYPES "CKSM NANN " AND WAITS 00050 FOR A CHARACTER TO BE INPUT. NINN IS THE 00051 BEGINNING ADDRESS OF THE BLOCK CONTAINING 00052

> "EXEC" AND WAITS FOR AN INPUT. TYPING AN X CAUSES THE PROGRAM TO GO EXBUG WHILE TYPING

AFTER READING THE G BLOCK THE PROGRAM PRINTS

THE CHECKSUM ERROR. TYPING A C CAUSES

THE PROGRAM TO CONTINUE LOADING. TYPING

AN X CAUSES THE PROGRAM TO GO TO EXBUG.

| 00060     |            |         | AYCA                                    | USES THE  | PROGRAM TO JUMP TO THE G   |
|-----------|------------|---------|---|-----------|----------------------------|
| 00061     |            | *       | ADDRES                                  | S. TYPIN  | ANY OTHER CHARACTER CAUSES |
| 00062     |            | *       | THE "E                                  | XEC" LOO  | TO REPEAT.                 |
| 00063     |            | *       |   |           |                            |
| 00064     |            | # REV   | <i>l</i> : 0                            |           |                            |
| 00065     |            |         |   |           |                            |
|           |            |         |   |           |                            |
|           |            |         |   |           |                            |
| 00067     |            |         | OPT                                     | 0,5       |                            |
|           |            |         |   |           |                            |
|           |            |         |   |           |                            |
|           |            |         |   |           |                            |
| *         |            |         |   |           |                            |
|           |            |         |   |           |                            |
| 00069     |            | * EXB   | JG EUUA                                 | ES        |                            |
| 00071     | F9CF       | OCHAR   | FOLI                                    | \$F9CF    | OUTPUT CHAR                |
| 00071     | F012       | INCH    | EQU                                     | \$F012    | INPUT CHAR                 |
| 00072     | FF53       | AECHO   |   | \$FF53    | INCH NO ECHO FLAG          |
| 00074     | FF8B       | BCKSM   |   | \$FF8B    | CHKSUM STORAGE             |
| 00075     | F564       | EXBUG   | 100000000000000000000000000000000000000 | \$F564    | EXBUG ENTRY                |
| 00076     | FF5A       | TEMP    | EQU                                     | SFF5A     | TEMP STORAGE               |
| 00077     | FB65       | MCKER   |   | \$FB65    | CKSM MESSAGE               |
| 00078     | F024       | PDATA   |   | \$F024    | PRINT CR LF DATA STRING    |
| 00079     | FA22       | OUT 4HS |   | SFA22     | OUTPUT 4 HEX CHAR SPACE    |
| 00080     | F908       | RDOFF   |   | \$F908    | READER OFF                 |
| 00081     | FCF4       | MTTYSO  |   | SFCF4     | MAID TTY STATUS OUTPUT     |
| 00082     | FCFD       | SBIT    | EQU                                     | \$FCFD    | ACIA STOP BIT CONTROL      |
| 00083     | FA4E       | INXCH   | EQU                                     | SFA4E     | IN CHAR ABORT IF X         |
| 00084     | F89B       | NCHNGE  | EQU                                     | \$F89B    | NO CHANGE MESSAGE          |
| 00085     | F70B       | EXEC    | EQU                                     | \$F70B    | EXEC CONVERSATION          |
| 00086     | FF8A       | STACK   | EQU                                     | SFF8A     | INZ STACK POINTER VALUE    |
|           |            |         |   |           |                            |
|           |            |         |   |           |                            |
|           |            |         |   |           |                            |
|           |            |         |   |           |                            |
|           |            |         |   |           |                            |
| 00088     |            | * SE    | T P-REG                                 | ISTER LOC | ATION                      |
| 00090 FF  | ı,         |         | ORG                                     | SFF16     |                            |
| 00090 FF1 |            |         | FDB                                     | START     |                            |
|           |            |         |   |           |                            |
| 00093 001 | 10         |         | ORG                                     | \$10      |                            |
| 00005 00  | 10 8E FF8A | CTADT   | I DC                                    | #STACK    | INZ STACK POINTER          |
| 00073 00  | TO OF LLOH | JIMIL   | LDS                                     | MOTHUR    | THE SIMON PUTHIER          |
| 00097 00  | 13 B6 FCFD |         | I DA A                                  | SBIT      | READER RELAY ON            |
| 00097 001 |            |         | AND A                                   | #\$55     | NUMBER NEEDS OF            |
|           | 18 B7 FCF4 |         | 0.00,000                                | MTTYSO    |                            |
| VVV77 VV  | LO DI FUPA |         | JIN N                                   | 1111130   |                            |

# Software To Come in SEPTEMBER Issue

TAPEMON — An 8080 Binary Tape Monitor with Autostart

by Dr. Alan Miller

Structured Programming by Ed Keith

**Depreciation Analysis Program JHDSAP** by Jim Huffman

**Tiny BASIC Extensions** by Leo Zolman

Game of Chase by Joseph Jay Sanger

| 00100<br>00101 | 001B<br>001D | 86<br>BD | 11<br>F9CF |        | LDA<br>JSR | A   | #\$11<br>OCHAR | TURN READER ON   |
|----------------|--------------|----------|------------|--------|------------|-----|----------------|--|
|                |              | •        |            |        |            |     |                |  |
| 00103          | 0020         | 8D       | 4F         | BEGIN  | BSR        |     | INPUT          | CTART OF RIMARWO   |
| 00104          | 0022         | 81       | 42         |        | DEC        | H   | B. R           | STAKE OF BINHKEY!  |
| 00100          | 0024         | 01       | A7         |        | DER        | ۸   | A/C            | CTART PROCESANO  |
| 00100          | 0028         | 24       | FA.        |        | PAF        | H   | REGIN          | MO   |
| 00108          | 0020         | 20       | 54         |        | RCR        |     | GETANN         | GET ANDRESS  |
| 00109          | 002C         | BD       | F908       |        | JSR        |     | RDOFF          | TURN READER OFF  |
| 00110          | 002F         | BD       | F70B       |        | JSR        |     | EXEC           | DO IT?   |
| 00111          | 0032         | FE       | FF5A       |        | LDX        |     | TEMP           | GET ADDRESS  |
| 00112          | 0035         | 6E       | 00         |        | JMP        |     | X              | START OF BINARY? YES START PROGRAM? NO GET ADDRESS TURN READER OFF DO IT? GET ADDRESS GO DO IT             |
|                |              |          |            |        |            |     |                |  |
| 00114          | 0037         | 7F       | FF8B       | RDBLCK | CLR        |     | BCKSM          | INZ CHKSUM   |
| 00115          | 003A         | 80       | 35         |        | BSR        |     | INPUT          | GET BYTE COUNT   |
| 00116          | 0030         | 16       |            |        | IAB        | D   |                | AD MET IT  |
| 00117          | 0030         | or<br>on | 40         |        | DCD        | В   | GETANN         | Inz Chksum<br>Get Byte Count<br>Put in B-ACC<br>Abjust It<br>Get Address                                   |
| 00110          | 0036         | OD       | 40         |        | DOM        |     | OCTABO         | OCT REDINESS   |
| 00120          | 0040         | 8D       | 2F         | STBLCK | BSR        |     | INPUT          | GET DATA   |
| 00121          | 0042         | A7       | 00         |        | STA        | A   | X              | STORE IT   |
| 00122          | 0044         | A1       | 00         |        | CHP        | A   | X              | STORED?  |
| 00123          | 0046         | 26       | 23         |        | BNE        |     | NOCHING        | NO   |
| 00124          | 0048         | 08       |            |        | INX        |     |                | INC ADDR   |
| 00125          | 0049         | 5A       |            |        | DEC        | В   |                | DEC BYTE COUNT   |
| 00128          | 004A         | 26       | F4         |        | BNE        |     | STBLCK         | STORE IT<br>STORED?<br>NO<br>INC ADDR<br>DEC BYTE COUNT<br>NOT DONE  |
|                |              |          |            |        |            |     |                |  |
| 00120          | 0040         | 70       | Z3<br>EEOD |        | DOR        |     | TMLOI          | VERIFT CHROUN  |
| 0012           | 0040         | 27       | CD         |        | BED        |     | RECTN          | VERIFY CHKSUM  |
|                |              |          |            |        |            |     |                |  |
| 00132          | 0053         | BD       | F908       |        | JSR        |     | RDOFF          | BAD-TURN READER OFF  |
| 00133          | 0056         | CE       | FB65       | PMSG   | LDX        |     | #MCKER         | PRINT MESSAGE  |
| 00134          | 0059         | BD       | F024       |        | JSR        |     | PDATA          |  |
| 00135          | 0050         | CE       | FF5A       |        | LDX        |     | #TEMP          | PRINT START ADDR   |
| 0013           | 005F         | BD       | FA22       |        | JSR        |     | OUT4HS         | considerate American   |
| 00137          | 0062         | BD       | FA4E       |        | JSR        |     | INXCH          | INPUT CHAR   |
| 00138          | 0065         | 81       | 43         |        | DEC        | A   | CTART          | CUNTINUE?  |
| 0013           | 0001         | 21       | H/<br>FR   |        | BEN        |     | DMCC           | BAD-TURN READER OFF<br>PRINT MESSAGE<br>PRINT START ADDR<br>INPUT CHAR<br>CONTINUE?<br>YES<br>INVALID CHAR |
| VVITO          | , 000,       | 20       | ш          |        | DIVIN      |     | 1100           | INVILID COM  |
| 00142          | 006E         | BD       | F908       | NOCHNG | JSR        |     | RDOFF          | NOT STORED-READER OFF  |
| 00143          | 006E         | . 7E     | F89B       |        | JMP        |     | NCHNGE         | TELL IT  |
| 00145          | i            | 200      |            | * REA  | D CHA      | RAI | CTER SUBR      | DUTINE   |
| 00146          | 0071         | 70       | FF53       | INPUT  | INC        |     | AECHO          | Turn off echo<br>Input Char<br>Save Char<br>Update Chksum  |
| 00147          | 00/4         | RN       | F012       |        | JSK        |     | INCH           | INPUT CHAR   |
| 00140          | 00//         | DD       | CEOD       |        | ADD        | H   | DCACM          | HODATE CHIPCIN   |
| 00150          | 0078         | R7       | FFRR       |        | STA        | A   | BCKSM          | STORE CHKSUM   |
| 0015           | 007E         | 32       |            |        | PUL        | A   | 201011         | store Chksum<br>Restore Char   |
| 0015           | 007E         | 39       |            |        | RTS        |     |                |  |
|                |              |          |            |        |            |     |                |  |
| 0015           | }            |          |            | # REA  | D ADI      | RE  | ss subrou      | TINE   |
| 0015           | 0080         | 80       | EF         | GETADD |            |     |                | GET START ADDR HI  |
| 0015           | 0082         | B7       | FF5A       |        | STA        | A   | TEMP           |  |
| 0015           | 0085         | 80       | EA         |        | BSR        |     | INPUT          | GET START ADDR LOW   |
| 0015           | 008/         | B/       | LL2R       |        | SIA        | A.  | TEMP+1         | get start addr low<br>addr to X-reg  |
|                | 3800         |          |            |        | RTS        |     | IEM            | HOUR TO ATREO  |
| 00100          | , voor       | , 37     |            |        | піэ        |     |                |  |
| 0016           | 2            |          |            |        | END        |     |                |  |
| OCHA           | F90          | FI       | NCH        | F012 A |            |     | F53 BCKSM      | FF8B EXBUG F564  |
|                |              |          |            |        |            |     |                | S FA22 RDOFF F908  |
| MTTY           | O FCF        | 4 9      | BIT        | FCFD I | NXCH       | F   | A4E NCHNG      | E F89B EXEC F70B   |
| STAC           | ( FFE        | A S      | TART       | 0010 B | EGIN       | 0   | 020 RDBLC      | K 0037 STBLCK 0040   |
| PMSG           | 005          | 6 N      | OCHNG      | 006B I | NPUT       | 0   | 071 GETAD      | D 0080   |
| TOTAL          | ERRO         | RS       | 00000      |        |            |     |                |  |
|                |              |          |            |        |            |     |                |  |

# **BILOAD OBJECT DUMP**

S00B000042494C4F4144202009

5008000042494C4F4144202009 \$115FF16001005 \$11E00108EFF8B6EFCFD8455B7FCF48611BDF9CF8D4F81422711814726F68D27 \$11E002854BDF908B6DF708FEFF5R6E007FFF8B8D35165C8D408D2FA700A10012 \$11E00462623085A26F48D237CFF8B27CDBDF908CEFB65BDF024CEFF5RBDFA91 \$11E0061228DFR4E814327A720EBBDF9087EF89B7CFF53BDF01236BBFF8B872E \$115007CFF8B32398DEFB7FF5A8DEAB7FF5BFFF5A39D5 \$9930000FC

# DIGI-KEY CORPORATION Quality Electronic Components

# DON'T FORGET OUR DISCOUNTS WHEN COMPARING PRICES **MICROPROCESSORS**

# **Best Values Yet!**

| 8080A  | 8-BIT CPU, 2 USEC CYCLE \$12.95                 |
|--------|---|
| 8212   | 8-BIT I/O PORT                                  |
| 8216   | BI-DIRECTIONAL BUS DRIVER \$ 4.25               |
| 8224   | CLOCK GENERATOR\$ 3.95                          |
| 8228   | SYSTEM CONTROLLER                               |
| 8251   | COMMUNICATIONS INTERFACE \$12.95                |
| 8255   | PERIPHERAL INTERFACE\$11.95                     |
| 1702A  | 2K EPROM (256x8)\$ 6.95                         |
| 2708   | 8K EPROM (1Kx8) \$29.50                         |
| 2102-1 | 1K RAM 500 NS\$ 1.79                            |
| SC/MP  | 5 VOLT SC/MP CPU                                |
| 2650   | MICROPROCESSOR 1.25 MH-2 CLOCK 40 DIL., \$24.95 |

ONE EACH 8080A, 8212, 8224 and 8228 PLUS SIXTEEN 2102-1's - ALL FOR

\$49.95

# PRICE BREAKTHROUGH ON 74LS'

| 74LS00<br>74LS01<br>74LS02<br>74LS03<br>74LS04<br>74LS05 | .28<br>.28<br>.28<br>.28<br>.29<br>.29 | 74LS30 .28<br>74LS32 .33<br>74LS37 .33<br>74LS38 .33<br>74LS40 .28<br>74LS42 .67 | 74LS90 .57<br>74LS92 .57<br>74LS93 .57<br>74LS107 .39<br>74LS109 .39<br>74LS112 .39 | 74LS157 .75<br>74LS158 .75<br>74LS160 1.02<br>74LS161 1.02<br>74LS162 1.02<br>74LS163 1.02 | 74LS248<br>74LS249<br>74LS253<br>74LS257<br>74LS258<br>74LS266 | .79<br>.84<br>.75<br>.75<br>.75 |
|--|--|--|---|--|--|---------------------------------|
| 4LS08  | .29                                    | 74LS47 .79   | 74LS113 .39   | 74LS164 1.02   | 74LS283  | .79                             |
| 4LS09  | .29                                    | 74LS48 .77   | 74LS114 .39   | 74LS168 1.14   | 74LS290  | .6.                             |
| 4LS10  | .28                                    | 74LS51 .28   | 74LS125 .49   | 74LS169 1.14   | 74LS293  | .65                             |
| 4LS11  | .28                                    | 74LS54 .28   | 74LS126 .49   | 74LS170 1.73   | 74LS365  | .67                             |
| 74LS12   | .28                                    | 75LS55 .28   | 74LS132 .81   | 74LS173 1.34   | 74LS366  | .67                             |
| 74LS13   | .47                                    | 74LS73 .39   | 74LS136 .39   | 74LS174 1.06   | 74LS367  | .67                             |
| 74LS14   | 1.02                                   | 74LS74 .39   | 74LS138 .73   | 74LS175 .84  | 74LS368  | .67                             |
| 74LS15   | .28                                    | 74LS75 .53   | 74LS139 .73   | 74LS190 1.18   | 74LS386  | .39                             |
| 74LS20   | .28                                    | 74LS76 .39   | 74LS151 .75   | 74LS191 1.18   | 74LS670  | 2.34                            |
| 74LS21   | .28                                    | 74LS78 .39   | 74LS153 .75   | 74LS196 .86  | 81 LS95  | .77                             |
| 74LS22   | .28                                    | 74LS83 .79   | 74LS154 1.10  | 74LS197 .86  | 81LS96   | .77                             |
| 74LS26   | .33                                    | 74LS86 .39   | 74LS155 .75   | 74LS247 .79  | 81 LS97  | .77                             |
| 74LS27   | .33                                    |  | 74LS156 .75   |  | 81LS98   | .77                             |
|  |  |  |   |  |  |                                 |

# INTEGRATED CIRCUITS TTL, CMOS, LINEAR

| 7400 .21             | 7476 .32                 | 74181 2.15             | 4012 .23              | 4520 1.   |
|----------------------|--------------------------|------------------------|-----------------------|---|
| 7401 .21             | 7480 .70                 | 74182 .79              | 4013 .40              | 4527 1.   |
| 7402 .21             | 7482 .70                 | 74184 2.19             | 4014 .96              | 4528 .  |
| 7403 .21             | 7483 .70                 | 74185 2.19             | 4015 .96              | 4528 .<br>4585 1.<br>2102-1 1.  |
| 7404 .21             | 7485 .89                 | 74188 3.50             | 4016 .40              | 2102-1 1.   |
| 7405 .21             | 7486 .28                 | 74189 3.50             | 4017 1.05             | 8080A 12.   |
| 7406 .25             | 7489 2.19                | 74190 1.23             | 4018 1.05             | CA3046 .:   |
| 7407 .25             | 7490 .44                 | 74191 1.23             | 4019 .23              | LM2111N 1.  |
| 7408 .21             | 7491 .70                 | 74192 .88              | 4020 1.14             | LM309K 1.8  |
| 7409 .21             | 7492 .44                 | 74193 .88              | 4021 1.14             | LM324A 1.   |
| 7410 .21             | 7493 .44                 | 74194 .88              | 4022 .96              | LM340T-5 1.   |
| 7411 .21             | 7494 .70                 | 74195 .88              | 4023 .23              | LM340T-6 1.   |
| 7412 .21             | 7495 .70                 | 74196 .88              | 4024 .84              | LM340T-8 1.   |
| 7413 .25             | 7496 .70                 | 74197 .88              | 4025 .23              | LM340T-12 1.  |
| 7414 .89             | 74100 1.28               | 74198 1.49             | 4026 1.68             | LM340T-15 1.  |
| 7416 .25             | 74107 .30                | 74199 1.49             | 4027 .40              | LM340T-18 1.  |
| 7417 .25             | 74109 .33                | 74251 1.09             | 4028 .89              | LM2111N 1.<br>LM309K 1.1<br>LM324A 1.1<br>LM340T-5 1.<br>LM340T-6 1.<br>LM340T-15 1.<br>LM340T-15 1.<br>LM340T-15 1.<br>LM340T-18 1.<br>LM340T-18 1.<br>LM340T-24 1.<br>LM390ON |
| 7420 .21             | 74121 .35                | 74279 .55              | 4029 1.14             | LM3900N .   |
| 7421 .25             | 74122 .44                | 74365 .67              | 4030 .23              | LM3909N .<br>MC1456V 1.   |
| 7423 .35             | 74123 .61                | 74366 .67              | 4033 1.51             | MC1456V 1.  |
| 7425 .35             | 74125 .40                | 74367 .67              | 4034 3.50             | MC1458V .   |
| 7426 .25             | 74126 .40                | 74368 .67              | 4035 1.14             | MC3302P 1.  |
| 7427 .33             | 74132 .70                | 8093 .40               | 4040 1.14             | NE536T 3.<br>NE540L 2.  |
| 7428 .28             | 74141 .88                | 8094 .40               | 4041 .79              | NE540L 2.   |
| 7430 .21             | 74145 .70                | 9095 .67               | 4042 .79              | NE555V .  |
| 7432 .25             | 74147 1.63               | 8096 .67               | 4043 .70              | NE556A .<br>NE560B 3.   |
| 7433 .30<br>7437 .25 | 74148 1.30<br>74150 1.16 | 8097 .67<br>8098 .67   | 4044 .70<br>4046 1.86 | NE560B 3.<br>NE561B 3.  |
|                      |                          | 8098 .67<br>75150 1.16 | 4046 1.86<br>4049 .40 |   |
|                      |                          | 75450 .88              |                       | NE562B 3.<br>NE565A 1.<br>NE566V 1.<br>NE567V 1.  |
| 7440 .21<br>7442 .53 | 74153 .65<br>74154 1.03  | 75450 .88<br>75451 .61 | 4050 .40<br>4051 1.26 | NE566V 1.   |
| 7442 .53             |                          | 75452 .61              | 4052 1.26             | NE567V 1.   |
| 7445 .70             | 74155 .70<br>74156 .70   | 75453 .61              | 4052 1.26             | UA709CV .   |
| 7446 .70             | 74157 .70                | 75454 .61              | 4060 1.58             | UA710CA .   |
| 7440 .70             | 74160 .88                | 75491 .81              | 4066 .79              |   |
| 7448 .70             | 74161 .88                | 75492 .84              | 4071 .23              | uA723CA   |
| 7450 .21             | 74162 .88                | 75493 1.09             | 4072 .23              | UA733CA .   |
| 7450 .21             | 74163 .88                | 75494 1.19             | 4073 .23              | UA741CV .   |
| 7453 .21             | 74164 .96                | 82525 2.19             | 4075 .23              | UA747CA   |
| 7454 .21             | 74165 1.15               | 4000 .23               | 4081 .23              |   |
| 7459 .21             | 74166 1.26               | 4001 .23               | 4082 .23              | uA748CV .<br>uA7805CU 1.  |
| 7460 .21             | 74170 2.64               | 4002 .23               | 4502 .79              | uA7806CU 1.   |
| 7470 .30             | 74173 1.42               | 4006 1.23              | 4510 1.14             | UA7808CU 1.   |
| 7472 .30             | 74174 .98                | 4007 .23               | 4511 1.05             | UA7812CU 1.   |
| 7472 .30             | 74175 93                 | 4008 70                | 4514 2.80             | UA7815CU 1.   |

# DIAMONI MS54 Length \$6.58 e Our Catalog For More Diamond Too A•C•E 200-K Part No. 923333



\$5.95 WSU-30M Modified Wrap . . \$6.95

# - UNWRAPS

TOTALLY ASSEMBLED CRT AT LOWER THAN KIT PRICE

\$700



No. 3365 \$12.5

| "   |  |
|-----|--|
| ate |  |
| 0   |  |



# **SILICON TRANSISTORS**

| ı |             |         | MPS3640 16 | 1.55/10 | PN5133 16 | 1.55/10 |
|---|-------------|---------|------------|---------|-----------|---------|
| ı | MPS91816    | 1.55/10 | MPS3641 16 | 1.55/10 | PN5134 16 | 1.55/10 |
| ı | MPS93016    | 1.55/10 | MPS3643 16 | 1.55/10 | PN5137 16 | 1.55/10 |
| ı | MPS2222A16  | 1.55/10 | MPS3646 16 | 1.55/10 | PN5138 16 | 1.55/10 |
| ı | MPS2369A16  | 1.55/10 | 2N3904 16  | 1.55/10 | PN5139 16 | 1.55/10 |
| ı | MPS2712 16  | 1.55/10 | 2N3906 16  | 1.55/10 | 2N5210 16 | 1.55/10 |
| l | MPS2907A16  | 1.55/10 | 2N4124 16  | 1.55/10 | DK3055 68 | 6.59/10 |
| ı | MPS3392 16  | 1.55/10 | 2N4126 16  | 1.55/10 | 2N3055 99 | 9.20/10 |
| ı | MP\$3393 16 | 1.55/10 | 2N4401 16  | 1.55/10 | MJ295599  | 9.20/10 |
| ı | MPS3394 16  | 1.55/10 | 2N4403 16  | 1.55/10 | MPF10236  | 3.35/10 |
| ı | MPS3395 16  | 1.55/10 | 2N4410 16  | 1.55/10 | 2N5457 48 | 4.50/10 |
| ı | MPS3563 16  | 1.55/10 | 2N5087 16  | 1.55/10 | MPSA1328  | 2.60/10 |
| ı | MPS3565 16  | 1.55/10 | 2N5089 16  | 1.55/10 | MJ2955 99 | 9.20/10 |
| ı | MPS3638 16  | 1.55/10 | PN5129 16  | 1.55/10 | TIP120 99 | 9.20/10 |
|   |             |         |            |         |           |         |

SEND FOR OUR FREE CATALOG WE STOCK A WIDE VARIETY OF PARTS NOT IN THIS AD PLUS MANY SPECIALLY PRICED BARGAINS!

# 5% CARBON FILM RESISTORS

1/4 & 1/2 WATT SIZE

5 pcs/value 5° ea., 100 pcs/value 1.7° ea, 1000 pcs/value 1.2° ea.

# CLOCK MODULES

switches and our special transformer and you have a fully functioning clock.

The MA1003 clock module is a fully assembled and tested 12 hour clock using a high brillia flaurescent display and crystal time base making it perfect for car, boat or other portod operates directly from 12 volts DC so no transformer is needed. Our price includes three pur switches for setting the time.

| MA1002A SET Module with Trans \$13.95                                     |  |
|---|--|
| MA1002C Seek Madule \$10.50   |  |
| MA1002C SET Module w/Transformer \$13.95<br>MA1003 12 Volt Colock \$24.95 |  |







# **ELECTROLYTIC CAPACITORS**

| ı | VALUE RADIA | IL LEADS | AXIAL L |         | ANTOL       | KADIAL UAU |     | IAL LEADS |
|---|-------------|----------|---------|---------|-------------|------------|-----|-----------|
| ı | .47/50V08   | .65/10   | .11     | .90/10  |             |            |     |           |
| ı | 1/50V 08    | .65/10   | .11     | .90/10  | 100/50V 21  | 1.17/10    | .29 | 2.30/10   |
| ١ | 2.2/50V 08  | .65/10   | .12     | .90/10  | 220/10V 13  | 1.08/10    | .18 | 1.42/10   |
| ı | 3.3/50V 08  | .65/10   | .12     | 1.00/10 | 220/16V 15  | 1.16/10    | .20 | 1.55/10   |
| ı | 4.7/35V 08  | .65/10   | .12     | .95/10  | 220/25V 21  | 1.71/10    | .29 | 2.35/10   |
| ı | 4.7/50V 08  | .68/10   | .12     | 1.00/10 | 220/35V 25  | 2.03/10    | .35 | 2.79/10   |
| ı | 10/16V08    | .65/10   | .11     | .90/10  | 220/50V 29  | 2.35/10    | .40 | 3.23/10   |
|   | 10/25V08    | .65/10   | .12     | 1.00/10 | 330/6V14    | 1.12/10    | .19 | 1.48/10   |
| ı | 10/35V      | .70/10   | .13     | 1.10/10 | 330/10V 15  | 1.16/10    | .21 | 1.64/10   |
| ı | 10/50V10    | .75/10   | .14     | 1.15/10 | 330/16V 21  | 1.66/10    | .31 | 2.45/10   |
| ı | 22/16V08    | .67/10   | .12     | 1.00/10 | 330/25V 23  | 1.86/10    | .38 | 3.07/10   |
| ı | 22/25V09    | .70/10   | .13     | 1.05/10 | 330/35V 33  | 2.66/10    | .43 | 3.43/10   |
| ı | 22/35V11    | .85/10   | .15     | 1.19/10 | 330/50V 54  | 4.30/10    | .60 | 4.81/10   |
| ı | 22/50V12    | 1.00/10  | .17     | 1.32/10 | 470/6V15    | 1.21/10    | .20 | 1.61/10   |
| ı | 33/16V09    | .75/10   | .12     | 1.00/10 | 470/10V 21  | 1.71/10    | .31 | 2.45/10   |
| ı | 33/25V10    | .81/10   | .14     | 1.15/10 | 470/16V23   | 1.81/10    | .33 | 2.66/10   |
|   | 33/35V13    | 1.05/10  | .17     | 1.34/10 | 470/25V 29  | 2.35/10    | .43 | 3.43/10   |
|   | 33/50V14    | 1.13/10  | .19     | 1.52/10 | 470/35V 41  | 3.27/10    | .47 | 3.78/10   |
|   | 47/10V09    | .71/10   | .13     | 1.04/10 | 470/50V 54  | 4.30/10    | .75 | 6.03/10   |
|   | 47/16V10    | .81/10   | .14     | 1.15/10 | 1000/6V 22  | 1.90/10    | .35 | 2.76/10   |
|   | 47/25V13    | 1.05/10  | .17     | 1.30/10 | 1000/10V24  | 1.96/10    | .38 | 3.07/10   |
|   | 47/35V14    | 1.13/10  | .19     | 1.51/10 | 1000/16V29  | 2.35/10    | .43 | 3.43/10   |
|   | 45/50V15    | 1.21/10  | .21     | 1.71/10 | 1000/25V42  | 3.33/10    | .68 | 5.42/10   |
|   | 100/10V 10  | .77/10   | .14     | 1.13/10 | 1000/35V60  | 4.81/10    | .75 | 6.03/10   |
|   | 100/16V 11  | .85/10   | .17     | 1.30/10 | 2200/6V 36  | 2.86/10    | .43 | 3.43/10   |
|   | 100/25V 13  | 1.10/10  |         | 1.55/10 | 2200/10V42  | 3.33/10    | .60 | 4.81/10   |
|   | 100/35V 17  | 1 41/10  | 25      | 1 93/10 | 2200/16V 54 | 4 30/10    | 68  | 5 42/10   |

| TTL IC's 595 p \$4.00       | 8 Pin Solder .17  | 1.60/1  |
|-----------------------------|-------------------|---------|
| Linear IC's 957 p \$5.00    | 14 Pin Solder .20 | 1.90/1  |
| CMOS 74C 256 p \$3.00       | 16 Pin Solder .22 | 2.10/1  |
| Memory IC's 592 p \$3.00    | 18 Pin Solder .29 | 2.75/1  |
| Interface IC's 464 p \$4.00 | 24 Pin Solder .38 | 3.60/1  |
|                             | 28 Pin Solder .45 | 4.25/1  |
| Volt. Regs. 128 p \$3.00    | 40 Pin Solder .63 | 6.00/1  |
| Linear Appl. 1 432 p \$4.00 | 8 Pin W-W .24     | 2.30/1  |
| Linear Appl. 2 246 p \$3.00 | 14 Pin W-W .26    | 2.50/1  |
| Audio 196 p \$3.00          | 16 Pin W-W .30    | 2.85/1  |
| MOS/L51 IC's 713 p \$4.00   | 18 Pin W-W .60    | 5.70/1  |
| CMOS 4000 278 p \$3.00      | 24 Pin W-W .96    | 9.10/1  |
| Angles Manual 637 n \$5.95  | 28 Pin W-W 1.12   | 10.00/1 |

# WIRE WRAPPING WIRE IN BULK

1000' \$15.00

### MOLEX IC SOCKET PINS

.85/C 8.20/M 38.20/5M 275.00/50

| JIM   | AMDED HOOK    | OF WIKE    |
|-------|---------------|------------|
| 20 ga | PVC 2.50/100' | 10.00/500" |
| 22 gg | PVC 2.80/100' | 11.25/500" |
| 24 ga | PVC 2.10/100' | 8.50/500"  |
|       | PVC 2.10/100' | 8.50/500"  |

# **50 VOLT DISCS**

| 100 pf    | 40/10 | 3.50/C |
|-----------|-------|--------|
| 220 pf    | 40/10 | 3.50/C |
| 470 pf    | 40/10 | 3.50/C |
| .001 uf . | 40/10 | 3.50/C |
| .0022 uf  | 40/10 | 3.50/C |
| .0047 uf  | 40/10 | 3.50/C |
| .01 uf    | 45/10 | 3.65/C |
| .022 uf . | 50/10 | 4.00/C |
| .047 uf . | 70/10 | 5.60/C |
|           |       |        |

# DOUBLE DIGIT DISCOUNTS SAVE YOU EVEN MORE!

# HANDLING

\$100.00 & Up . . . No Charge

# VOLUME DISCOUNT

0.00-\$ 24.99 . . . . N 25.00-\$ 99.99 . Less 10 100.00-\$499.99 . Less 15 en odd to this sub. \$ 25.00.\$ 99.99 . Less 10% mitoble items. Add \$ 100.00.\$499.99 . Less 15% . This is your total shipping and in. \$ 500.00.\$999.99 . Less 20% s in the U.S.A. and \$ 1000.00 & Up . . . Less 25%

300 Caps 18 Values

\$26.00

ZENER DIODES

# SILICON DIODES

# DIGI-K

Quality Electronic Components Thief River Falls, MN 56701 (218) 681-6674 P.O. Box 677 26 go PVC. . 2.10/100' 8.50/500' 1 uf. . . 1.35/10 11.50/C P.U. BOX 0// Intel River rails, mix 30/01 (216) 001-0074

# TIC TAC

# by Bud Shamburger

```
PROGRAM NAME "TICTAC"
  10 ' PROGRAM NAME "TILTAC"
20 ' MITS BASIC VERSION 4.0
30 ' PROGRAMMED BY: BUD SHAMBURGER JAN 1977
40 ' #27 RED OAK DR
50 ' CONNAY. ARK 72032
60 ' A SIMULATED GAME OF TIC-TAC-TOE WITH THE COMPUTER. THE COMPUTER
70 ' MAKES A COUPLE OF STUPID MOVES AND ALLOWS THE PLAYER TO WIN SOME-
80 ' TIMES TO MAKE THE GAME A LITTLE MORE INTERESTING
90 DEFINT A-2
100 T=0
110 DIM S(8)
99 DEFINT R-Z
100 T=0
110 DIM S(8)
120 FOR I=0 TO 8
130 LET S(I)=0
140 NEXT I
150 PRINT
150 PRINT
160 IF T=0 THEN 180
170 INPUT "ANOTHER GAME"; L$: IF L$="YES" THEN T=1: GOTO 180
180 T=1: PRINT CHR*(26)
190 PRINT"IC-TAC-TOE"
200 PRINT" IC-TAC-TOE"
220 PRINT" 4 *5 *6"
230 PRINT" 4 *5 *6"
230 PRINT" 7 *8 *9"
250 GOSUB 830
260 IF A=5 THEN 290
270 S(4)=7
280 GOTO 330
290 IF S(0)<0 THEN 320
380 LET S(0)=7
310 GOTO 330
320 S(2)=7
330 GOSUB 920
340 GOSUB 930
350 GOSUB 930
350 GOSUB 1110
360 IF R<0 THEN 410
370 PRINT
     360 IF R<>0 THEN 410
370 PRINT
380 PRINT"YOU WIN, YOU CHEAT!"
     390 GOSUB 920
400 GOTO 120
410 A=0
    410 A=0
420 FOR I=0 TO 8
430 IF S(I)<>0 THEN 450
440 H=1
450 NEXT I
460 IF A=1 THEN 500
470 PRINT
480 PRINT"YOU WERE SAVED BY A GOOD FAIRY! THE GAME IS DRAWN. "
490 GOTO 350
500 IF R<>2 THEN 590
510 S(B)=7
520 GOSIB 1110
    510 S(B)=7
520 GOSUB 1110
530 IF R(>1 THEN 570
540 PRINT
550 PRINT" | WIN! HA! HA!"
  340 FRINT" I WIN! HA! HA!
550 BRINT" I WIN! HA! HA!
550 GOSUB 920
550 GOSUB 920
550 GOSUB 920
550 GOSUB 920
650 S(B)=7
610 GOTO 540
620 IF S(4)<70 THEN 650
630 S(4)=7
640 GOTO 570
650 IF S(0)<70 THEN 680
660 LET S(0)=7
670 GOTO 570
680 IF S(2)>60 THEN 710
690 LET S(2)=7
700 GOTO 570
710 IF S(6)<70 THEN 740
720 S(6)=7
     710 1F 5(5) 70 THEN 740
720 5(6)=7
730 GOTO 570
740 IF 5(8)<70 THEN 770
750 5(8)=7
760 GOTO 570
 730 GUIU 770
740 IF S(8)<0 THEN 770
750 S(8)=7
750 GOTO 570
770 I=1
780 IF S(I)<0 THEN 810
790 S(I)=7
800 GOTO 570
810 I=1+2
820 GOTO 570
830 PRINT
850 INPUT 8
850 IF S(R-1)=0 THEN 900
870 PRINT "HUH? YOU CAN'T MOVE THERE DUMMY! IT'S MY SQUARE!"
890 GOTO 840
900 S(R-1)=1
910 RETURN
920 PRINT
930 FOR I=0 TO 6 STEP 3
940 FOR J=0 TO 2
```

```
950 K=I+J
 960 B=S(K)
970 IF B<>0 THEN 1000
980 PRINT" ";
 990 GOTO 1040
1000 IF B<>1 THEN 1030
1010 PRINT" X ";
1010 PKINI" X ";
1020 GOTO 1040
1030 PRINT" O ";
1040 IF J=2 THEN 1060
1050 PRINT"*";
1060 NEXT J
1070 PRINT
1120
1130
                  GOSUB 1330
IF RC>V THEN 1160
 1140 R=0
1150 RETURN
1160 V=21
1160 V=21

1170 GOSUB 1330

1180 IF RC>V THEN 1210

1190 R=1

1200 RETURN

1210 V=14

1220 GOSUB 1330

1230 IF RC>V THEN 1260

1240 R=3

1250 RETURN

1260 V=2

1270 GOSUB 1330

1280 IF RC>V THEN 1310

1290 F=2
  1290 R=2
1300 RETURN
1310 R=4
  1320 RETURN
  1330 F=0
1340 E=2
  1350 I=1
  1350 1-1
1360 GOSUB 1800
1370 IF RC2V THEN 1390
1380 RETURN
 1380 RETURN
1390 F=3
1400 E=5
1410 I=1
1420 GOSUB 1800
1430 IF R<>V THE
1440 RETURN
                                               THEN 1450
  1450 F=6
1460 E=8
1470 I=1
1470 I=1
1480 GOSUB 1800
1490 IF RC>V THEN 1510
1500 RETURN
1510 F=0
1520 E=6
1530 I=3
1540 GOSUB 1800
1550 IF RC>V THEN 1570
1560 RETURN
1570 F=1
1580 E=7
1590 I=3
 1580 E=7
1590 I=3
1600 GOSUB 1800
1610 IF RCDV THEN 1630
1620 RETURN
1630 F=2
1640 E=8
1640 E=8

1650 I=3

1660 GOSUB 1800

1670 IF RC>V THEN 1690

1680 RETURN

1690 F=8

1710 I=4

1720 GOSUB 1800

1730 IF RC>V THEN 1750

1740 RETURN

1750 F=2

1760 E=6

1770 I=2
1760 E=6
1770 I=2
1780 GOSUB 1800
1790 RETURN
1800 R=0
1810 FOR J=F TO E STEP I
1820 R=R+S(J)
 1830 IF 5(J)<>0 THEN 1850
1840 B=J
1850 NEXT J
```

# CRAZY BALL — EMCB

# by Elliott Myron

If you are using a PolyMorphic VTI display board with your 8080 Microprocessor, this discussion will allow you to play video games such as Ping Pong and Crazy Ball. This software theme is about a video game called 'Crazy Ball'. This is a game of skill for one player. The game is played on a field similar to that of handball. A paddle can be raised or lowered to hit a moving ball. The paddle is controlled through the terminal keyboard. Pressing the '1' will raise the paddle on the screen, and pressing the '2' will lower the paddle position. The object is to his the 'Crazy Ball' before it goes out of bounds.

Before presenting the game listing itself, a few words of explanation seem appropriate. The game is written using MIT's 8K BASIC Rev. 3.1 which has been modified to allow communication with the PolyMorphic VTI board. The program itself uses approximately 3.6K bytes of RAM. The screen address set for the VTI board is 7C00 (HEX) which corresponds to 31744 (decimal) for the first address on the screen. All Poke and Peek addresses used with BASIC are relative to this VTI address of 31744. Line 1 in the program sets the VTI address into the program (P = 31744). Also indicated in line 1 is: CS = 5 and PRINT CHR\$(CS).

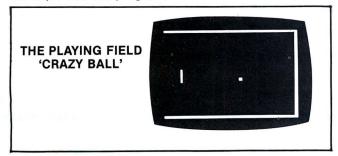
The Basic which I use is modified to clear the screen when PRINT CHR\$(5) is executed. If your BASIC does not have a similar feature, you can substitute the following: FOR CS = TO 16:PRINT:NEXT CS.

In line 110 the command IP=INP(124) is used. INP(124) inputs directly from the keyboard input port. Since the board is set at 7C(HEX) which is equal to 124 (decimal), the INP(124) statement will input the decimal equivalent of the last character entered from the keyboard. For this game, an ASCII 1 (177 in decimal) is used to indicate a 'move paddle up' command. An ASCII 2 (178 in decimal) means 'move paddle down'. Anything else causes the paddle to stop.

The above technique may be used with many graphic games. It is possible to use additional keys on the terminal to mean 'move left' and 'move right', and to even 'fire' graphic missiles at various targets. In addition, it is possible to use the input port found on the front panel of some computers. I have personally used two input ports (keyboard and front panel) to play Ping Pong with two players. In a future article, I will detail the construction of a control box which has the keys needed to cause moves in the desired directions. This control box will fit into any available parallel input port, and does not require any hand-shaking signals.

# CRAZY BALL PROGRAM

See Microcomputer Software Depository Program Index for copies of this program.



```
1 CS=5:P=31744:PRINTCHR$(CS):GOTO1000
2 INPUT"DO YOU WANT DIRECTIONS":A1
3 IF LEFT$(A$.1)="Y" THEN 900
10 P=31744:CS=5:TP=54:BT=27:LF=0:RT=63:PO=7
 11 PRINT CHRS (CS)
14 REM SET UP FIELD
15 FORI=1T063:POKEP+1.TP:NEXT
16 POKEP+64.160
16 POKEP+64.160
26 FORI=961T01023:POKEP+1.BT:NEXT
25 FORI=65 TO 897 STEP-64:POKEP+1.LF:NEXT
30 FORI=63 T01023 ST2P-64:POKEP+1.RT:NEXT
37 REM SET UP PADDLE
40 DP=503+P:POKEDP.PD
100 IP=INP(1)
101 BP=453+P:SYM=45:F1=1:GOSUB600
102 T=U
105 POKESP.SYM
109 REM CHECK PADDLE POSITION
110 [P=INP(124)]
111 IF I=177 THEN 125:REM PADDLE UP
115 IF IP=178 THEN 135:REM PADDLE DOWN
117 REM ANY OTHER KEY WILL FREEZE THE PADDLE
120 GOTO 200
          IF PEEK(DP-64)=160 THEN POKEDP.160:DP=DP-64:GOT0145
          G0T0 200
IFPEEK(DP+64)=160 THEN POKEDP.160:DP=DP+64:G0T0145
 140 GOTO 200
145 POKEDP.PD
200 REM MOVE BALL
201 J=INT(RND(1)*7+3)
 202 FORM:1TOJ
203 IF N:J THEN 300
204 IF PEEK(BP+F1)=160 THEN POKEBP.160:8P=8P+F1:GOTO210
          GOTO 220
POKE BP . SYM: NEXT
 215 6010110
215 GOTO 110
220 K=PEEK(BP+F1)
222 IFK=RT THEN 240:REM OUT OF BOUNDS
224 IF K=PD THEN 260:REM HIT PADDLE
225 IF K=F THEN 270:REM HIT LEFT SIDE
230 GOTO 210
240 PRINTCHRS(CS)
242 PRINT"TOTAL = "T
244 IMPUT"ANDTHER TRY":AS
246 IF LEFTS(AS+1)="Y" THEN 11
250 END
260 F1=-1:GOSUB600
262 T=T+1
          GOT 0 2 0 4
          F1=1:G0SU8600
G0T0110
 300 IFF2 = OTHEN204
300 IFF2=0THEN204
301 IFF2=1 THEN 400:REH DOWN
304 REH UP
305 IF SYM=45 THEN SYM=27:G0T0204
310 IF SYM=54 THEN SYM=45:G0T0204
310 IF PEEK(BP=64+F1)=160 THEN 330
310 F2=-1:G0T0204
310 POKEBP-160:18P=8P-64+F1:SYN=54:GOT0204
400 [Fsyn=45 Then Syn=54:GOT0204
401 [F syn=27 Then Syn=45:GOT0204
405 [FPEEK(BP+64+F1)=160 THEN 420
          F2=1:G0T0204
P0KEBP.160:BP=BP+64+F1:SYM=27:G0T0204
 500 REM GET RANDOM DIRECTION FOR Y AXIS (F2)
                                                       .5)-INT(RND(2)+.5)
 603 IF F 2=F3 THEN 602
           PETHEN
600 RETURN
900 PRINT:PRINT:PRINT"MOVE THE PADDLE UP OR DOWN TO HIT THE SALL."
901 PRINT:PRESS THE FOLLOWING KEYS:"
902 PRINTTAB(10):"KEY #1 . . . . . UP"
903 PRINTTAB(10):"KEY #2 . . . . DOWN"
904 PRINTTAB(10):"SPACE KEY . . . . FREEZE"
905 PRINTIPRINT:THE OBJECT IS TO GET AS MANY POINTS AS POSSIBLE."
906 PRINT:PYOU GET ONE POINT EVERY TIME THE BALL HITS THE PADDLE."
910 INPUT"READY":AS:IFLEFTS(AS.1):"Y" THEN 10
 911 GOTO 910
 1000 FOR I=1T051: READA1: READA2
1001 FOR J=A1T0A2: POKEP+J.0: NEXTJ
1002 NEXTI
1000 PKINTCHR3(C5):G0T02
1010 DATA 0.5.8.13.19.21.27.35.38.40.44.46
1015 DATA 64.65.72.73.76.77.95.99.103.105.107.109
1010 DATA 82.83.85.86
1020 DATA 128.129.136.140.145.151.156.159.169.171
1025 DATA 192.197.200.201.204.205.208.209
1020 DATA 215.216.219.27.233.235
1030 DATA 459.466.474.476.483.484.494.495
1035 DATA 523.524.530.531.537.538.540.541.547.548.558.559
1035 DATA 523.524.530.531.537.538.540.541.547.548.558.559
1040 DATA 587.593.600.406.611.612.622.623
1045 DATA 651.652.658.659.663.664.670.671.675.676.686.687
1030 DATA 715.722.726.727.735.736.739.747.750.758
1104 POKEP-1.61
1105 POKEP-1.61
1107 POKEP-1.60
1108 POKEP-3883-383-1.60
1110 POKEP-3883-383-1.60
1111 POKEP-1.60.61
1111 POKEP-1.60.61
 1114 POKEP+I+66.160
1115 POKEP+383+383-I-66.160
 1120 FOR JETTO300: NEXTJ: GOTO1006
```

# **MICROCOMPUTER**

| A0808       | 6 %     | DYNAMIC RAMS     | 3_           | MISC OTHER         |               | SHIFT REGISTE                           | RS            | USRT                   |              |
|-------------|---------|------------------|--------------|--------------------|---------------|---|---------------|------------------------|--------------|
| SUPPORT DE  | VICES   | 414D (16P)       | 5.50         | COMPONENTS         |               | DYNAMIC                                 |               | S-2350                 | 13.50        |
| 8212        | 4.00    | 1103 (16P)       | 1.50         | NH0025CN           | 1.75          |   | 2.00          | IM-6403                | 10.80        |
| 8214        | 12.95   | 2104 (16P)       | 6.50         | NH0026CN           | 3.00          | 1404AN<br>2405                          | 3.00<br>4.95  | TMS-6011 (TI)          | 6.25         |
| 8216        | 5.25    | 2107B (22P)      | 4.50         | N8T20              | 4.00          | 2505K                                   | 3.00          | TR-1602A (WD)          | 6.25         |
| 8224        | 6.00    | 2107B-4 (22P)    | 4.00         | N826               | 3.25          | AND | V.5.000000000 |                        |              |
| 8228        | 9.25    | TMS4050 (18P)    | 4.50         | N8T97              | 1.45          | SHIFT REGISTER                          | RS            | UARTS                  |              |
| 8238        | 8.20    | TMS4060 (22P)    | 4.50         | 74367              | 1.00          | STATIC                                  |               | AY5-1013               | 6.75         |
| 8251        | 12.00   | 4096 (16P)       | 5.50         | DM8098             | 1.00          | MM506                                   | .89           | AY5-1013<br>AY5-1014A  | 6.75<br>9.95 |
| 8253        | 28.00   | MM5262 (22P)     | 3.00         | 1488               | 1.95          | 2509K                                   | 1.00          | A 15-1014A             | 9.95         |
| 8255        | 12.00   | MM5270 (18P)     | 5.00         | 1489               | 1.95          | 2518B                                   | 3.95          |                        |              |
| 8257        | 22.00   | MM5280 (22P)     | 6.00         | 3205               | 6.20          | 2533V                                   | 2.00          | CHARACTER              |              |
| 8259        | 22.00   |                  |              | D-3207A            | 2.50          | TMS3002                                 | 1.00          |                        |              |
| 6800 SUPPOR | Т       | STATIC RAMS      |              | C-3404             | 3.95          | TMS3112                                 | 3.95          | GENERATORS             |              |
| 6810P       | 6.00    | 31L01            | 2.00         | P-3408A            | 6.75          | MM5058                                  | 2.00          | 2513                   | 6.75         |
| 6820P       | 8.00    | 91L11A           | 4.25         | P-4201             | 4.95          |   |               | 2513                   | 6.75         |
| 6828P       | 9.60    | 91L12A           | 4.25         | MM-5320            | 7.50          | FIFO                                    |               | 3257                   | 18.00        |
| 6834P       | 21.95   | 1101A            | 1.00         | MM-5369            | 2.00          | 3341A                                   | 6.75          | MCM6571                | 10.80        |
| 6850P       | 12.00   | 2101             | 3.00         | DM-8130            | 3.00          | 2812-D                                  | 11.95         | MCM6571A               | 10.80        |
| 6852P       | 17.00   | 2102 (10S)       | 1.25         | DM-8131<br>DM-8831 | 2.50          | KEYBOARD CHI                            | De            | MCM6572                | 10.80        |
| 6860P       | 15.00   | 2102-1 (5.00NS)  | 1.50         | DM-8833            | 2.50          |   |               | MCM6581                | 8.75         |
| 6862P       | 18.00   | 2M1A-4           | 4.45         | DM-8835            | 2.50          | AY5-2376                                | 14.95         |                        |              |
| 6880P       | 2.70    | 2112A-4          | 3.00         | SN74LS367          | 2.50<br>1.00  | AY5-3600                                | 14.95         | WAVEFORM               |              |
| Z80         |         | 2501B            | 1.45         | SN74LS367          | 1.00          | TV GAME CHIPS                           | _             | WAVEFORW               |              |
| SUPPORT DE  | VICES   | 3107             | 2.95         | 3117423300         | 1.00          | TMS 1955 (6 Game                        | es)           | GENERATOR              |              |
|             |         | *4200A (250NS)   | 13.75        | Managana           | 2000          |   | 10.95         | 8038                   | 4.50         |
| 3881        | 15.95   | 410D (200NS)     | 11.95        | MICROPROCES        |               | AYSS-8500 (6 Gan                        | nes)          | MC4024                 | 2.75         |
| 3882        | 15.95   | *4804            | 20.00        | F-8                | 19.95         |   | 10.95         | 566                    | 2.00         |
| F-8 SUPPORT | DEVICES | 5101<br>74C89    | 20.00        | Z-80               | 36.95         | KITS                                    |               |                        |              |
| 3851        | 14.95   | 74C89<br>74S201  | 3.00<br>4.75 | Z-80A              | 49.95         |   |               |                        |              |
| 3852        | 14.95   | 91L02A           | 2.00         | CDP1802DC          | 29.50         | MEC 6800 DZ                             | Design        |                        | 235.00       |
|             |         | 7489             | 2.00         | AM2901             | 22.95         | 8080A Kit                               |               | it (All Parts to Build |              |
| FLOPPY      |         | 8225             | 1.50         | 6502<br>6800       | 24.95         | F1                                      |               |                        | 100.00       |
| DISC CONTRO | OLLER   | 8599             | 1.50         | 8008-1             | 24.95<br>8.75 | Educator II                             |               | ter hobbyist Beginne   |              |
| PD372D      | 65.00   | 82S09            | 9.00         | 8008-1<br>8080A    | 8.75<br>15.95 | Education II                            |               |                        | 169.95       |
| 1771        | 69.95   | *Limited supply. | 0.00         | 8080B              | 16.95         | Educator II                             |               | Supply by Motorola     | 20.05        |
| 1//1        | 05.50   |                  |              |                    |               |   | (Desig        | ned for Educator II)   | 29.95        |
|             | -       |                  | CDEC         | TALCOFT            | HE MC         | MTH                                     |               |                        |              |

# SPECIALS OF THE MONTH

2708 E-PROM Price \$24.00 ea.

1-24 21L02 (350NS) (Low Power) 25-99 100-499 500-999 1.58 1.48 1.43 1.33 21L02 (250NS) (Low Power) 2.00 1.80 1.65 1.50

# **8K RAM BOARD KIT \$159.95**

# **FEATURES**

- S-100 Connector compatible.
- Low profile sockets provided for all RAMs and IC's.
- Low-power Schottky support chips.
- Dip switch selection of memory address assignment and wait cycles.
- Memory protect can be set for increments of 256 bits, 512 bits, 1K, 2K, 4K or 8K by DIP switch.
- Low profile sockets provided for all RAMs and ICs.
- Gold plated edge connector contacts.

Discounts available at OEM quantities. Add \$1.25 for shipping. California residents add 6% sales tax.





E CONNECTORS for RS232 Solder type DB(25-S) (Femal Solder type DB(25-P) (Male) Male & female (25-P & 25-S)

CONNECTORS

Electronics for the Hobbyist and Experimenter

5351 WEST 144th STREET LAWNDALE, CALIFORNIA 90260 (213) 679-3313

# SOCKETS

I C SOCKETS SOCKETS

Lo Pro Tin
Transistor IC-10 Gold
Lo Pro Tin
Wire Wrap Gold
Lo Pro Tin
Standard P C Tin
Wire Wrap Tin
Lo Pro Tin
Wire Wrap Tin
Lo Pro Tin
Wire Wrap Tin
Lo Pro Open Frame Tin
Wire Wrap Tin
Lo Pro Open Frame Tin
Wire Wrap Tin

# FIFO FLEA MARKET

FOR SALE — QUME daisy wheel 45CPS printer, factory modified for Diablo-Xerox wheels (Model 3/X40). New with manual, 4 daisy wheels, ribbons, power supply, but no interface. Cost \$2367 but will sacrifice. (518) 794-8080, ask for Sikander.

FOR SALE: KSR TTY Model 33. Recently reconditioned. Works and looks good. Friction feed. \$600.00. Bob Hanel, 22850 Crenshaw Blvd., Torrance, CA. Phone (213) 530-3035 wk days and (213) 541-5011 evenings and weekends.

FOR SALE: 2 GODBOUT ECONORAM 4K Memories at \$90 each, 1 Solid State Music 4K Memory at \$85, 1 MITS 1K Memory at \$45 and 1 Processor Technology 3P-S Interface Board at \$120. All boards are in good working order. Rob Alkire, 520½ N. Moore Ave., Monterey Park, CA, (213) 289-3264 (before 3pm).

FOR SALE: DigiDeck<sup>TM</sup> Cassette Transports with tech. manual and all electronics (from TTL compatible parallel control). Can be used as incremental or continuous mode of operation. These are used but very clean and physically complete. Don't have time to check them out, however. \$145.00 ea. plus shipping. Jim Beistle, 3728 Wilkie Way, Ft. Worth, TX 76133.

FOR SALE: Lightly oiled 1" wide TTY paper tape, 5 rolls per box—\$2 plus postage on 8 lbs; 30 rolls per case—\$10 plus postage on 48 lbs. P.O. Box 13303, Omaha, NE 68113.

FOR SALE: QUAY 80 A1 do everything ZPU. A complete stand-alone computer. Add AC power and terminal and Go. Plugs in your Altair or IMSAI, Z80 CPU. 1K static RAM (low power), 512 byte (ROM) monitor, comes up running. 4 UVEPROM sockets (2708). UVEPROM programmer. Assembled and tested \$475.00. TDL ZPU with software 8K Basic, 2K Monitor, Text editor, Macro Assembler, all on paper tape with documentation, \$275.00. VECTOR GRAPHIC mother board with 5 sockets, \$45.00. MFE model 250 super cassette drive, high speed search (40 ips), 800 bpi w/case, connector, special cassette, lots of documentation NEW!!, cost \$510.00, your cost \$250.00.

RCA 1801 microprocessor, six 2101 static RAMs, user manual and program development guide, all for only \$40.00. Paul Lamar, 1024 17th St., Hermosa Beach, CA 90254, (213) 374-1673.

FOR SALE: MITS ALTAIR 8800 main frame with 8K Dynamic RAM, 8K BASIC (cassette), SIOA and ACR interface boards and extender board. Up and running! Also: SWTP CT-1024 terminal kit (unassembled) less chassis or CRT. All in excellent condition, but I need the cash and must sell these items fast! Make your offer! Chris Foreman, 7447 Loma Verde Ave., Canoga Park, CA 91303, (213) 346-6730 evenings.

FOR SALE: I have 2 Tri-Data I/O 1800 words/sec. Each unit has 1.25 megabyte storage capability. Complete with 5 cartridges and manuals. Excellent condition. These units sold new for \$6,000. Perfect for minicomputer application at \$500. Robert Erickson, (612) 772-1654, 877 Flandrau, St. Paul, Minn. 55106.

FOR SALE: Imsai PI04-4 Par. and SI02-2 ser. interface boards. \$155 each. Cables also available. Various 4K RAM boards. \$125 each. All assembled and tested. Byte #1 thru 4, \$10. Trade any boards toward floppy disc? Dieter Kaetel, 7201-87 S.E., Mercer Island, WA 98040. (206) 232-1513.

FOR SALE: Altair 8800, 4K Static, 4K Dynamic, Serial I/O (RS232 Compatible), Tarbell Cassette Interface, Complete Documentation. New, cost \$1576. Barely used & totally functional: \$1375 or best offer. Norm, (213) 341-1275, 8505 Lurline Ave., Canoga Park, CA 91306.

FOR SALE: IMSAI 8080 system with 20K bytes of RAM (5 IMSAI 4K boards), 512 bytes of EPROM on a 4K board, Poly-Morphic video interface (64 char./line), North Star hardware arithmetic board, IMSAI Multiple I/O board, 22-slot motherboard with all edge connectors, kevboard with upper/lower case, video monitor, cassette tape recorder, all cables for IMSAI MIO plus other assorted cables, assembler and North Star BASIC software adapted for Poly video board. Also have HP9810A system with cassette tape storage unit and plotter, and lots of software. L.A. airport vicinity. Gary Bedrosian, 3412 Alma Avenue, Manhattan Beach, CA 90266. Call (213) 487-3035 weekdays or (213) 546-1687 evenings or weekends.

FOR SALE: ASCIISCOPE 12x80 \$550.00 with documentation, solid state music MB3 with 4K 1702A \$125.00, MITS 4K dynamic \$125.00, Proc Tech VDM \$170.00, 3P+S \$135.00, Pennywhistle MODEM \$80.00, OAE Tape Reader \$65.00, IMSAI 4K Static \$120.00. All assembled, fully socketed and factory checked out. K.R. Roberts, 10560 Main St., Suite 515, Fairfax, VA 22030.

FOR SALE: PERTEC 7850 9Tr magtape Drives w/elec, \$275 w/man;  $\pm$  12/3A &  $\pm$  5/5A supplies, \$25; Superior Elec TRP125 120Byt/S opt readr, \$200; IVC 600 Color Video recorders w/man. \$300 (orig. \$2700) w/tape; MSI FD8 disc case & pwr sply \$85. Gary Gaugler, 2276 Beaver Valley Rd., Fairborn, OH 45324, (513) 878-0288.

FOR SALE: IMSAI 8080 with 22 slot mother board \$649., PolyMorphic video board VTI-64 \$199., Vector graphic 8K memory board \$235., Solid State Music 8K memory board \$225., Radio Shack keyboard with custom case \$49., and a Tarbell cassette interface \$109. Assembled, tested, in excellent condition. Call (714) 870-1387 or write to B. Marr, 1800 Brea Blvd., Box 18, Fullerton, Callifornia 92635.

WANT ED: Mini-Processor Computer like SOL 20 or IMSAI 8080 with 24K memory. Peripherals such as printer, CRT or adapted TV, Floppy Disk System, Alpha-Numeric Keyboard or other components that can be used with record keeping and teaching in Youth Oriented Ministry of Small Church. Would appreciate this as a donation. Will give a tax deductible receipt in letter form. You determine the value for tax purposes. Write Rev. Jack Weaver, Pastor; Palmetto Bible Chapel, 16255 S.E. 82 Avenue, Perrine, Florida 33157 or call (305) 238-4837.

FOR SALE: 4 Solid State Music 4K RAM boards, wired and tested. 90.00 each. P. Sargent, 4209 Knoxville, Lakewood, CA 90713. (213) 421-9521.

FOR SALE: HP9815A programmable calculator w/extended memory, carry case, 4 cartridges, thermal paper, manuals; exc. cond. Over \$3600 new, asking \$2600. Walt Goldys, 200 S. Glenn Dr., #53G, Camarillo, CA 93010. (805) 482-4674.

FOR SALE: SWTPC CT-1024 terminal with keyboard, power supply, computer cursor control, and RS232 I/O board PLUS Case (aluminum). All assembled and tested. For: \$195.00. Write: E. V. Lipps, 205 Chautauqua, Pacific Palisades, CA 90272 or phone (213) 454-7690 (after 4 PM).

# FIFO FLEA MARKET ADS ★ PERSONALS FREE ★

Max. 10 lines per ad. Submit Ads to: FIFO Ads—INTERFACE AGE Magazine, P.O. Box 1234, Cerritos, CA 90701.

# MICRO-MARKET

Introductory Offer

Sys 2 \$550 POLY-88 IMSAI 22 Slot \$600 8KSC-Z \$250 SEALS Check our prices on your needs. We will not be UNDERSOLD!

**AAAA Computer How's** 1477 Barrington, Suite 17 W. Los Angeles, CA 90025 (213) 477-8478

# SOUTH FLORIDA Sunny Computer Stores, Inc.

Authorized Dealer: IMSAI, Southwest, Cromemco, CSC, Vector and others Books, Magazines, Newspapers, Service and Supplies **University Shopping Center** 1238A South Dixle Highway Coral Gables, Fla. 33146 (305) 661-6042

# THE COMPUTER CORNER

"Brains are our Business

- ✓ IMSAI 8080, POLY-88, Processor Tech
- ✓ Books, Magazines, TTY Supplies, Brain Games

Hours: 10-6 pm daily & Sat.; Thurs. 10-9 pm White Plains Mall, 200 Hamilton Ave.

WHITE PLAINS, NY 10601 Telephone: (914) 949-DATA

# End your video display problems quickly with a "PIXE-VERTER"

A manistorized modulated oscillator which instantly converts a Tyreceiver into a top north video monitor. Connects directly to antenn terminals. No wring, modulerations required to the set. Operates on channels 2-6. Power requirements 5-6 volts 3 ma. Ideally suited to computers, electronic james. TV caneras, video recorders, etc. Size 1.25" x 2.1". Kit model :PXV-2A S8-50. Order by phone or mail

- DIAL 402-987-3771 -

ATV Research 13-1 BROADWAY DAKOTA CITY. NEBR. 6873

# Washington, D.C. Area COMPUTER SYSTEMS STORE

Microprocessors & Terminals for: Home, School & Small Business 1984 Chain Bridge Road McLean, VA 22101 703/821-8333

Sargent's Distributing LAKEWOOD, CA 90713 4209 KNOXVILLE

| KEYBOARDS! NEW ASCII ENCODED 53 Keys, ASR-33 format, 2 key roll over. Data and strobe invert. Rugged G-10 board. Kit Price \$60.00 Assm \$72.00 Optional Case \$15.00 |
|---|
| S-100 Wire Wrap Proto Board Bare Board\$20.00 Mini Kit\$29.95   |
| S-100 System 4 Front Panel Auto Load System with 12 Command 8080 Monitor prog.  Kit Price\$80.00  Assm\$120.00  |
| System 4 plan set   |



# OUT OF MEMORY - AGAIN?!

Another board-Another socket-More power & heat! STOP!!

# Get our 32K MEMORY on a SINGLE BOARD

- Plug Compatible for Digital Groups Z-80 System
- \*400 Nanosecond Access Time
  \*Uses the Z-80's Refresh
  \*Very Low System Power Requirements
  \*64K Bytes Implemented with Only Two Boards
- \$295 8K Bytes assembled and tested \$99 Each add'l 4K installed when Board purchased \$100 Each add'l 4K installed separately \$90 4K Memory Kit for user installation 90 - 4K Memory Kit for user installation

# MICRO SYSTEMS ENGINEERING P. O. Box 20271 Minneapolls, Minnesota 55420

PROGRAMMABLE, Versatile Constant Current Source. D/A or manual control. Uses - Magnetic deflection, robot control, curve tracing, precise process control, magnetic positioning, linear motor drive . . . Input: 10 to 30V; Adjustable 0 to 100 ma. Features: Upper and Lower Limit Set; D:A/on-board/ remote control; D/A interface capability; Digital/Manual shut-off; over current protect; 10 usec response. \$49.95.

**ELECTRONIC SPECIALISTS, INC.** Dept. IF, 171 South Main Natick, Massachusetts 01760

# **VIDEO CHECKERS**

As described in March Issue but now complete. Plays under MITS 8K Basic. Total of 16K memory and poly video board required. Send \$10 postpaid for Tarbell format cassette and complete documentation.

COMPU-QUOTE 6914 Berquist Ave., Canoga Park, CA 91307

## Computer Mart of New York Inc. 118 Madison Avenue ★ New York, N.Y.

Microcomputers, Books, Components, Parts Authorized Dealer—Service—Friendly Advice Closed Monday

Open 10-6 Tues.-Sat. 10-9 pm on Thurs.

STAN VEIT, Storekeeper

Telephone (212) 686-7923

# **MARKET YOUR SOFTWARE**

CALL OR WRITE

Microcomputer Software Depository 2361 E. Foothill Boulevard Pasadena, California 91107 (213) 449-0616

COMPUTER HOBBYISTS!
Nationwide Classified
Advertising Newsletter
Buy & Sell Hardware & Software
new/used/unique/low-cost
\$3.75 for 18 issues. Free sample issue on request.
ON\_LINE Newsletter
24695 Santa Cruz Hwy, Los Gatos, Ca. 95030

. . .

# **★ FAIRCHILD F-8 USERS★**

2708 E-PROM programmer, \$59.95 193448 Prom programmer, \$69.95 uses 11/2 I/O ports & Fairbug Optimal Technology, Inc. Blue Wood 127, Earlysville, VA 22936

# **TELETYPES \$775**

Model 33 ASR . Newly refurbished RS232 • full/half duplex 30 day warranty

# THE MULL CORPORATION

1155C Chess Drive, Suite H Foster City, CA 94404 (415) 349-2599

## FLIMINATE INTERFERENCE

Keep Power Line noise & transients out of your system. Bonus! No more TV, Stereo or Radio interference. Wires directly into computer, teletype, power supply. Postpaid. ELF-3 \$9.50 — 3 amp Line Filter ELF-10 \$12.50 — 10 amp Line Filter Filter/Transient ELF/T-3 ( 3 amp) \$14.25 Suppressor ELF/T-10 (10 amp) \$17.25 ELECTRONIC SPECIALISTS, INC. 171 So. Main, Natrick, Mass 01760

# 21 SHOESTRING START-AT-HOME COMPUTER BUSINESSES

113 page research report uncovers areas never published. \$12.00 (Check, Mastercharge, Bankamericard) Guaranteed Refundable.

### DATASEARCH

730 Waukegan, Suite 108-F Deerfield, IL 60015

# ADD COLOR TO EXISTING TV GAMES WITH A"CHROMA-PLEX 7700" DIGITAL CHROMA MULTIPLEXER KIT!

EASILY ADAPTED TO MOST BLACK and WHITE GAMES, (i.e., Ceneral Instrument 5-game chip = AT-3-8500.) CMOS MOS FET CIRCUITRY. LOW POWER REQUIREMENTS: 7.0 Y reg. \$25ma. 3-5 8" x 4" double-sided plated board. DOZENS OF COLOR COMBINATIONS POSSIBLE. VERY VERSATILE. EASILY ASSEMBLED IN ONE EVENING. \$35.00 P.P. ORDER BY PHONE OF MAIL. DIAL 402 987-3771.

Research 13-1 BROADWAY

DAKOTA CITY, NE. 68731

MICRO-MARKET AD RATE: \$25.00 per column inch. Max. 4 column inches per ad. Submit ads to Micro-Market Ads-INTERFACE Magazine, P.O. Box 1234, Cerritos, CA 90701

PET User Group

for people interested in the new Commodore PET 2001 Computer. First year membership \$5 including User Notes and program exchange.

P.O. Box 371 Montgomeryville, PA 18936

# KIM-1

\$245

- Immediate Delivery
- Assembled and Tested
- •Includes all manuals, keypad, display, cassette & TTY I/O, interrupts, timers, process I/O, 2K ROM monitor, 1K RAM
- Special-includes KIM-1 MICROCHESS
- Power Supply + 5V, + 12V \$25
- •KIM four part music package \$35
- •Write for new low 4K, 8K RAM prices

# A B Computers

P.O. Box 104, Perkasie, PA 18944

A COMPUTER THAT THINKS IN BASIC!



- - NAU FEATURES:

    OSI'S Powerful BK BASIC on ROM.

    4K Bytes of RAM (expandable) for User Programs
    RS-232 or 20 ma LOOP Output
    Selectable Baud Rates: 110-300-1200-2400-or 4800
    Easily coupled to a Teletype or a Video Terminal

AS A STUDENT TRAINER IN . . .

NG COMPUTER SCIENCE - MATH PHYSICS

OR JUST TO BALANCE YOUR CHECKBOOK ACCOUNTING

MODEL 500

rd less enclosure and power supply \$298.00 MODEL 500-1

Fully enclosed with power supply & reset switch MODEL 500-8

The 500 Board inside a "Challenger" Case w/power supply

\$629.00 QUANTITY DISCOUNTS UP TO 30 %

P.O. Box 1221 MICROCOMP Fond du Lac. WI 54935

# ORDERS BACKLOGGED? WE CAN HELP YOU FAST

PC board and small mechanical assembly are our specialty. Lead bending, wave soldering and consciencious competent attention to detail are our resources. We also know how to control costs. Our prices will asround you. Call or write to me:

> Marlin J. Ebert, General Manager **Electro Manufacturing Corporation** 2582 First Street Livermore, California 94550 (415) 447-4848

# **CAST YOUR VOTE**

The authors of this issue would like to know your feelings as to which article you consider the best. You may cast your vote on only one article. Select the best article and circle the corresponding number on the readership service card.

At the end of the voting period all votes will be tallied, the highest scoring article will be announced and the author will receive a \$100 bonus.

Since we have recently changed computing services, please note the address change on the reader service card to:

INTERFACE AGE Magazine, Box 2654, Clinton, Iowa 52732.

# ARTICLES

- Local Sidereal Time and Date by James J. Brennan
- 390 Local Mean Time by James J. Brennan
- 391 A KIM-1 Sidereal/Solar Clock by John O. Bumgarner
- 392 Solar Eclipse Prediction by Microcomputer by Nickey Naumovich, Jr.
- 393 Computing the Positions and Orbits of the Planets by Timothy O'Shaughnessy
- 394 Viking UPLINK/DOWNLINK by Sven Grenander
- 395 Star-Ship Simulation Part I by Roger C. Garrett
- 396 The COSMAC Microprocessor by Brian Kapitan
- 397 Some Remarks on Memories by Gordon Berry
- 398 FORTRAN/BASIC Conversions by William C. Thompson III
- 399 TIC TAC by Bud Shamburger
- 400 Crazy Ball by Elliott Myron

MAY WINNER: Robert Uiterwyk's 4K BASIC Interpreter Program by William W. Turner

**INTERFACE AGE 175** AUGUST 1977

# There's an iCOM for Everyone at these Computer Stores...

# ARIZONA

Byte Shop Tempe (602) 894-1129

### CALIFORNIA

Orange Computer Ctr. Costa Mesa (714) 646-0221

Byte Shop Lawndale (213) 371-2421

Byte Shop Mt. View (415) 969-5464

Computer Mart Orange (714) 633-1222

Byte Shop Pasadena (213) 684-3311

Byte Shop Santa Barbara (805) 966-2638

Byte Shop Santa Clara (408) 249-4221

Byte Shop San Diego (714) 565-8008

Byte Shop San Rafael (415) 457-9311

Computer Room San Jose (408) 226-8384

Byte Shop Tarzana (213) 343-3919

Tech-Mart Tarzana (213) 344-0153

Byte Shop Thousand Oaks (805) 497-9595

Byte Shop Walnut (415) 933-6252

Byte Shop Westminster (714) 894-9131

# COLORADO

Prime Radix Denver (303) 573-5942

### **FLORIDA**

Byte Shop Miami (305) 264-2983

The Computer Store Jacksonville (904) 725-8158

## ILLINOIS

Itty Bitty Machine Evanston (312) 328-6800

Numbers Racket Champaign (217) 352-5435

Champaign Computer Champaign (217) 359-5883

# INDIANA

Data Group Indianapolis (317) 842-2983 Information

### KENTUCKY

Cybertronics Louisville (502) 499-1551

# MASSACHUSETTS

American Used Computer Boston (617) 261-1100

### **MINNESOTA**

Microprogramming Burnsville (612) 894-3510

# NEW HAMPSHIRE

Computer Mart Nashua (603) 883-2386

# **NEW JERSEY**

Computer Mart Iselin (201) 283-0600

# **NEW YORK**

Synchro Sound Hollis (212) 468-7067

Computer Mart NYC (212) 686-7923

# NORTH CAROLINA

Digital Dynamics Charlotte (704) 374-1527

# PENNSYLVANIA

Byte Shop Brymar (215) 525-7712

# **SOUTH CAROLINA**

Carolina Computers Columbia (803) 798-6524

### **TEXAS**

Micro Store Richardson (214) 231-1096

Microtex Houston (713) 780-7477

Computer Terminal El Paso (915) 542-1638

# WISCONSIN

Madison Computer Madison (608) 255-5552

## CANADA

Computer Mart Toronto (416) 484-9708

Computer Place Toronto (416) 598-0262

8

8

# iom microperipherals

6741 Variel Ave., Canoga Park, CA 91303 U.S.A. Tel. (213) 348-1391 a division of Pertec Computer Corporation

# ADVERTISER INDEX

| Information<br>Inquiry<br>Number |                                    | Page           |
|----------------------------------|------------------------------------|----------------|
| MANUFACTU                        | RERS                               |                |
| 1                                | Alpha Microsystems                 | 114, 115       |
| 92                               | Alpha Supply Company               |                |
| 2                                | Artec Electronics                  |                |
| 3                                | BYTE Magazine                      |                |
| 5                                | California Computer Products       |                |
| 6                                | Canada Systems                     | 84             |
| 7                                | Comten Industries                  |                |
| 8                                | CreaComp                           |                |
| 9<br>10                          | Cromemco                           | 100 101        |
| 11                               | Digital Equipment                  |                |
| 12                               | Digital Group                      |                |
| 13                               | dilithium/Matrix                   | 108, 109       |
| 14                               | E & L Instruments                  |                |
| 15                               | Egbert Electronics                 |                |
| 16<br>17                         | Electronic Control Technology      |                |
| 18                               | Franklin Electronics               |                |
| 19                               | George Risk Industries             |                |
| •                                | HAL Communications                 |                |
| •                                | Hayden Book Company                |                |
| 21,22                            | Heathkit                           |                |
| 23                               | Info 2000                          |                |
| •                                | INTERFACE AGE Back Issues          |                |
| •                                | INTERFACE AGE Magazine             | 92             |
| 26                               | Lear Siegler                       |                |
| 27<br>28                         | MecaMicrodesign                    |                |
| 29                               | Micro Designs                      |                |
| 30                               | Micromation                        |                |
| 31                               | Microterm                          |                |
| 32                               | Microware Corporation              |                |
| 33<br>34,35,36                   | Midwest Scientific                 | 19             |
| 34,35,36                         | MPI                                |                |
| 38                               | National Multiplex                 |                |
| 39                               | Objective Design                   |                |
| 40                               | Ohio Scientific Instruments        |                |
| 41                               | OK Machine & Tool                  | 83             |
| 42<br>43                         | Osborne & Associates               |                |
| 44,45                            | Parasitic Engineering              |                |
| 46                               | Peripheral Vision                  |                |
| 47                               | Personal Computing                 | 23, 24, 25, 26 |
| 40                               | PolyMorphic Systems                |                |
| 48<br>49                         | Processor Technology               | 14, 15         |
| 50                               | Scientific Research                |                |
| 51                               | Sharp & Associates                 |                |
| 52                               | SWTP                               |                |
| 53                               | Sylvanhills Lab                    |                |
| 54<br>55                         | Technical Design Labs              | BC             |
| 56                               | TEIVandenberg Data                 | 35             |
| 57                               | Vector Graphic                     |                |
| 58,59                            | Wameco                             |                |
| 60                               | Wintek                             |                |
| 61                               | Xybek                              |                |
| COMPUTER S                       | STORES                             |                |
| 62                               | Bits N Bytes, Fullerton, CA        | 132            |
| 63                               | Bits & Bytes, Phoenix, AZ          |                |
| 64                               | Byte Shop, Inc.                    | 139            |
| 65                               | Byte Shop, Tempe, AZ               |                |
| 66<br>67                         | Byte Shop, Lawndale, CA            |                |
| 68                               | Byte Shop, Westminster, CA         | 120            |
| 69                               | Byte Shop, Miami, FL               | 117            |
| 70                               | Byte Shop, OH                      | 120            |
| 71                               | Computer Components                | 151            |
| 72                               | Computer Enterprises               | 140            |
| 73<br>74                         | Computer Machine Services          | 148            |
| 75                               | Comp Mart, NY                      | 120            |
| 76                               | Computer Store                     | 153            |
| 77                               | Computer Warehouse                 | 133            |
| 78                               | Disc 3                             |                |
| 91<br>79                         | Kit Builders                       | 117            |
| 80                               | Sunshine Computer Company          | 141            |
| 81                               | Tech Mart                          |                |
|                                  |                                    |                |
| SURPLUS STO                      |                                    |                |
| 82,83<br>84                      | Advanced Micro Computers           | 158, 162       |
| 85                               | Atwood Enterprises                 |                |
| 86 \                             | Integrated Circuits                | 150            |
| 87                               | Jade Company                       | 172            |
| 88                               | Parts Terminal                     | 165            |
| 89                               | Quest                              | 157            |
| *Manufactur                      | S. D. Sales                        | 164            |
| Manuracturer                     | r requests factory-direct inquiry. |                |

# READER SERVICE CARD READER SERVICE CARD Void after November 30, 1977 (Please type or print)

□ Business

Zip.

Void after November 30, 1977

|   | (Please type or print)                  |  |
|---|---|--|
| Name  |   |  |
| Title   |   |  |
| Company Ph  | one (A/C)                               |  |
| Address   | ☐ Home ☐ Business                       |  |
| City State_   | Country Zip                             |  |
| ANSWER THE FOLLOWING BY CHECKING ONE BOX ONLY PER QUESTION.  1. I Am A A. Professional (Medical, Accounting, Law, Etc.) B. Engineer (Electronics, Mechanical Etc.) C. Business Person (Retail, Wholesale, Etc.) D. Educator (Professor, Teacher, Assistant, Etc.) E. Student F. Hobbyist G. Other | E.   Research F.   Design & Development |  |

☐ Magazines ☐ Exhibits & Conventions

Club Meetings
 Direct Mail From Manufacturers.
 Other \_\_\_\_\_\_

7. I prefer To Buy
A. 

Directly From Manufacturers
B. 
Local Computer Retailer (Store)
C. 
Mail Order

8. I Look To INTERFACE AGE First For

D. Club Group Purchases
E. Other

New Product Information
Software Information
Tutorials
Hardware Articles

E. ☐ Product Advertising
F. ☐ Remarks \_\_\_\_\_

ANSWER THE FOLLOWING BY CHECKING ONE BOX ONLY PER QUESTION.

A. □ Professional (Medical, Accounting, Law, Etc.)
B. □ Engineer (Electronics, Mechanical Etc.)
C. □ Business Person (Retail, Wholesale, Etc.)
D. □ Educator (Professor, Teacher, Assistant, Etc.)

E. D Student F. ☐ Hobbyist G. ☐ Other \_\_\_

2. My Status Is
A. 

Have All Computing Equipment Need More Peripherals
 Need More Per

3. I Need This Information For

Title Company

Address

☐ Immediate Purchase
☐ Purchase 30-60 Days
☐ Comparisons D. □ Literature Library

4. My Interest Emphasis Is A. ☐ Hardware
B. ☐ Firmware
C. ☐ Software
D. ☐ Other \_\_\_\_

5. My Application is
A. | Hobby Only
B. | Business Only
C. | Hobby & Business
D. | Instruction Purposes
E. | Research
F. | Design & Development
G. | Other

\_ □ Home

\_Country\_

 My Primary Source Of "State-of-the-Art" Information Comes From:
 Magazines B. Exhibits & Conventions C. ☐ Club Meetings
D. ☐ Direct Mail From Manufacturers. □ Other

7. I prefer To Buy
A. □ Directly From Manufacturers
B. □ Local Computer Retailer (Store) ☐ Mail Order

D. □ Club Group Purchases
E. □ Other 8. I Look To INTERFACE AGE First For

B. I Look To INTERFAC.

A. □ New Product Information

C. □ Tutorials

D. □ Hardware Articles

E. □ Product Advertising

F. □ Remarks

Please send information on items circled below 10 11 12 36 37 13 38 40

30 31 32 33 34 35 36 37 38 39 40 41 55 56 57 58 59 60 61 62 63 64 65 66 80 81 82 83 84 85 86 87 88 89 90 91 45 70 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 155 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 177 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 21 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400

Phone (A/C)

State\_

Please use only 1 card per person. Thanks!

Please send information on items circled below.

2. My Status Is

2. My Status II

A. | Have All Computing Equipment

B. | Need More Peripherals

C. | Have CPU Only

D. | Have No Equipment

E. | Other

3. I Need This Information For

☐ Immediate Purchase
☐ Purchase 30-60 Days
☐ Comparisons

4. My Interest Emphasis Is

☐ Literature Library

E. Other .

A. ☐ Hardware
B. ☐ Firmware
C. ☐ Software

C. ☐ Softwa D. ☐ Other

20 45 70 95 10 31 32 56 57 81 82 33 34 35 36 37 38 39 40 58 59 60 61 62 63 64 65 83 84 85 86 87 88 89 90 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 17 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 1771 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400

Please use only 1 card per person. Thanks!

# READER SERVICE CAR

# SUBSCRIPTION APPLICATION FORM **PAYMENT MUST ACCOMPANY FORM**

SUBSCRIPTION FEE per year: \$10.00 U.S., \$12.00 Canada/Mexico, \$18.00 Foreign. Must be in U.S. funds drawn on a U.S. bank.

Make check payable to:

intenface" Magazine P.O. Box 1234, Cerritos, CA 90701

| Name         |             | Title                        |               |
|--------------|-------------|------------------------------|---------------|
| Company      |             |                              |               |
| Home Address |             |                              |               |
| City         | State       | Country                      | Zip           |
| Date         | Signature   |                              |               |
| СНЕСК        | MONEY ORDER | BANKAMERICARD sortioner dans | master charge |
|              |             |                              |               |

Expires Account # .

# PLANNING TO MOVE?

Let us know 8 weeks in advance so that you won't miss a single issue of/INTERFACE.

Attach old label where indicated and print new address in space provided. Also include your mailing label whenever you write concerning your subscription. It helps us serve you promptly.

If you have no label handy, print OLD address here.

|   | E  |
|---|----|
| į | ā. |
|   | m  |
|   | S  |
|   | a  |
|   | a  |

|      |         |         | Zip code |
|------|---------|---------|----------|
|      |         |         | State    |
| Name | Company | Address | City     |

Print NEW address here Affix Label

| -    |         |         | State |
|------|---------|---------|-------|
| Name | Company | Address | City  |

# MAIL COMPLETED CARD TO:

# JUICHEALE Magazine

Cerritos, California 90701 P.O. Box 1234





Permit No. 217 Clinton, lowa First Class

# **BUSINESS REPLY MAIL**

No Postage Stamp Necessary if Mailed in the United States

Postage will be paid by



**Box 2654** 

Clinton, lowa 52732

Permit No. 217 Clinton, lowa First Class

# **BUSINESS REPLY MAIL**

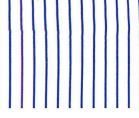
No Postage Stamp Necessary if Mailed in the United States

Postage will be paid by



**Box 2654** 

Clinton, lowa 52732



Rich Man, Poor Man, Merchant, Physician, Teacher, Lawyer, Student, Musician....



There's an iCOM Floppy Disk System for Everyone!

# More Uses

People from every walk of life are adding iCOM® Floppy Disks to their microcomputers for such diverse tasks as payroll, inventory control, mailing lists, game playing, record

keeping, parts ordering.

We've uncovered some innovative applications, too: The sailboat architect who puts equations and algorithms on an iCOM disk to test his nautical theories; the student who has automated a bowling alley; the iCOM dealer who designed an environmental control system for a university.

# More Speed

These users have found iCOM floppies to be much faster and more versatile than cassette or paper tape.

With iCOM. programs can be loaded in seconds; files updated in minutes hundreds of programs can be stored on a single disk.



# More Models

iCOM has Frugal Floppies™, Dual Floppies, Microfloppies™ (using the new 5¼" diskette), and other new approaches to floppy disk systems. Each is hardware and software compatible with Altair™, IMSAI, Poly 88, Sol-20 and other microcomputers using the Altair S-100 bus format.



# More Software

Then there's iCOM's famous software: Powerful field-proven FDOS-II with macro-assembler, stringoriented text editor, and file manager. Plus easy-to-use compatible 8K Disk BASIC. Each with super features such as: named variable length files, autofile create, open and close, multiple merge and delete . . . and more.

See us in Atlantic City

# More Backup

We've been building floppies for microcomputers for more than 3 years. Long before the rest. Thousands of systems are operating perfectly in the field. And we're part of Pertec Computer Corporation, one of the largest manufacturers of peripherals, microsystems, data entry products and data processing systems. We'll be around whenever you need us.

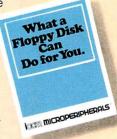
## More Dealers

Maybe not in quantity, but in quality. We've chosen our dealer network carefully to assure you of assistance every step of the way. Our prices are right. Our delivery is fast. Our dealers are

experienced and knowledgeable.

# Must Reading

Our free booklet, "What a Floppy Disk Can Do for You is must reading. Send for yours today or visit your dealer.



© 1977, Pertec Computer Corporation



# IS YOUR DOLLAR BUYING AS MUCH POWER & FLEXIBILITY AS TDL'S XITAN SYSTEMS PROVIDE?

OUR CUSTOMERS SAY THINGS LIKE THIS ABOUT TDL PRODUCTS: "... the best CPU board I've put together... excellent parts... worked right off without trouble shooting." ... JRG
Cambridge, Mass.

"Great product." ... KMM
Bella Vista, Ark.

"... high quality components, good engineering & complete documentation... up and running without any problems." ... WP
Seattle, Wash.

"Excellent." ... Col. DWW
Santa Maria, Calif.

"Very impressed with superb quality." ... SK-L
Boston, Mass.



When we combined our highly praised ZPU board and our System Monitor Board, we defined the standard for the industry; we integrated more power and flexibility in two slots of our motherboard than most other systems can muster using five or more boards. When we put this setup into our rugged aluminum case we created the first XITAN system, the alpha 1. By adding a CRT terminal and/or teleprinter you will have a complete computer system.

KIT: \$769 ASSEMBLED & TESTED: \$1039



By adding a Z16 memory module and our PACKAGE A software to the alpha 1 we created a second XITAN system, the alpha 2. Thus, a complete and extremely powerful micro-computer system emerges well worthy of you who are operating at the most sophisticated levels. The XITAN alpha 2 provides you with 18K of RAM, 2K of ROM, 2 serial I/O ports, 1 parallel I/O port, our 1200 baud audio cassette interface as well as our extraordinarily powerful software package which includes 8K Basic, the Text Output Processor, the Zapple Text Editor and the Relocating Macro-Assembler. Add your own I/O device and GO...with the most powerful and flexible micro-computer package ever offered.

KIT: \$1369 ASSEMBLED & TESTED: \$1749

IF YOU ARE A BEGINNER, YOU WON'T EASILY OUTGROW THE XITAN SYSTEM. IF YOU ARE AN ADVANCED USER, YOU WILL DISCOVER XITAN IS EXACTLY WHAT YOU NEED.

†Write for descriptive brochure on the XITAN **alpha** series and system software. When you ask at your dealer, say "ZY-TAN."

ORDERING INFORMATION: Send check, money order or BankAmericard, Master Charge current number and expiration date. Shipping is usually made via UPS or UPS Blue Label. Specify other arrangements if you wish. Prepaid orders are shipped postpaid.



RESEARCH PARK BLDG, H 1101 STATE ROAD PRINCETON, NEW JERSEY 08540 (609) 921-0321